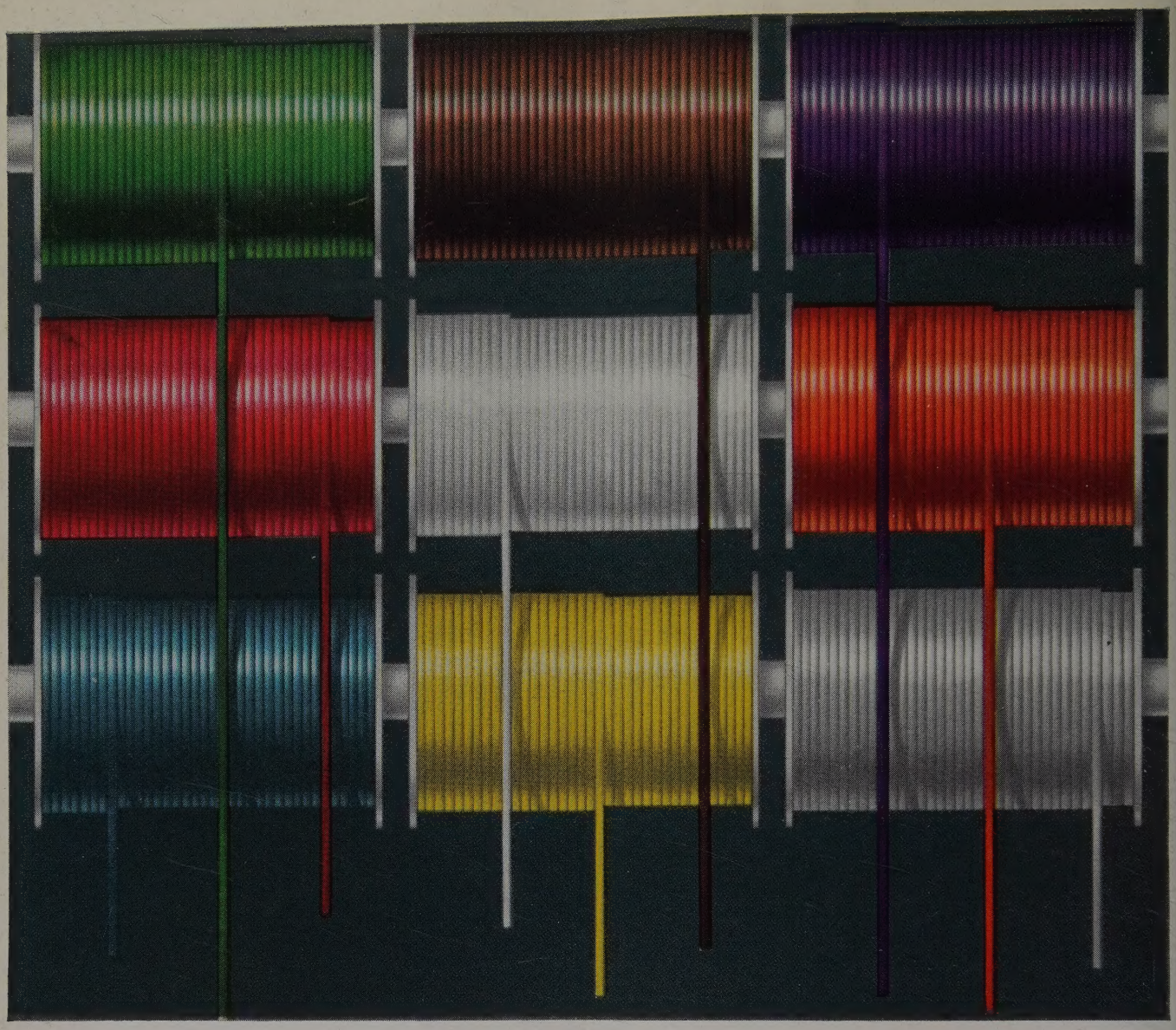
July 1961

Insulation

Encapsulation and lead time . . . page 25

In this issue:



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ONE THOUSAND FOOT ASSORTMENT

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- 1000 foot assortment
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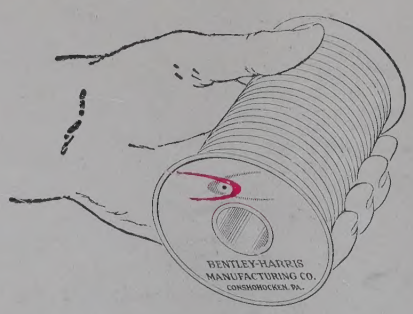
- Low investment
- Convenient inventory



BEN-HAR "1151"
durasyl
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Print Ins. 2 on Reader Service Car

It would be misleading to claim that Prehler customers are always happy since they may have to worry about personal problems such as the dog ruining the neighbor's flowers. But we do claim that as a general rule Prehler customers are happy with Prehler.

The reasons are simple. Prehler offers a complete line of electrical insulating materials . . . the customer selects exactly what he requires and there is no need or desire to "hard-sell" a customer into buying expensive material when another is more economical. Also, the customer knows that he can nearly always obtain what he needs promptly from convenient, local warehouse stocks. And just as important, the customer is able to buy and specify with intelligence and confidence because he has learned that he can rely on the insulation material and application know-how of the Prehler sales engineer who specializes exclusively in electrical insulation. What's more, when new developments and problems arise, the Prehler customer knows that every Prehler man is backed up with the research facilities and ingenuity of the country's leading insulation producers.

These are the reasons why Prehler customers are happy. They'll make you happy, too — a phone call to your nearest Prehler office will make all of us happy.

PREHLER ELECTRICAL INSULATION CO.

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Branch Offices

Cleveland 30, Ohio, 12200 Brookpark Rd., CLearwater 1-1800

Detroit 2, Mich., 411 Piquette Ave., TRinity 5-4020

St. Paul 1, Minn., 367 Grove St., CApital 5-4321

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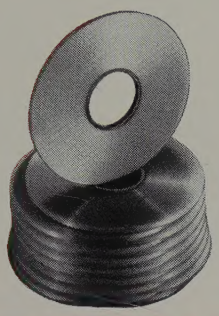
Everything in Precision-Slit Electrical Insulation

Inmanco®

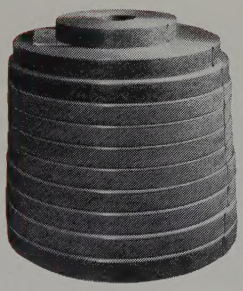
Thin Film and Film Combinations



MATERIALS	Mylar†	Cellulose Acetate	Teflon†	Polyethylene	Mylar-Dacron† Matte Combinations
NOMINAL THICKNESSES	.00025" through .010"	.00088" through .010"	.002" through .015"	.0015" through .010"	.008" .009" .011"
AVAILABLE WIDTHS	⅛" and up	¼" and up	¼" and up	¼" and up	⅛" and up
NORMAL TOLERANCES IN WIDTH	±.010"				
STANDARD O.D. COILS ½" AND WIDER ON 3" I.D. CORES	Maximum 9½"				
STANDARD O.D. COILS UNDER ½" WIDE ON 3" I.D. CORES	4" to 6"				

† DuPont Trademark.

Paper and Paper Combinations



MATERIALS	All-Rag Papers	Tan Electrical Kraft Papers	Fibre or Fishpaper	Paper-Varnished Cambric Combination	Mylar† or Acetate-Paper Combinations
NOMINAL THICKNESSES	.005" .007" .010" .015" .020" .025"	.005" .007" .010" .015" .020"	.004" to .031"	.010" through .028"	.006" through .021"
AVAILABLE WIDTHS	3/16" and up	3/16" and up	1/16" and up	3/16" and up	3/16" and up
NORMAL TOLERANCES IN WIDTH	Coil widths under 1", ± 2%				
	Coil widths 1" and over, ± 1/32" or 1%, whichever is greater				
STANDARD DIA. COILS ANY STANDARD CORE SIZE	Approximately 15" O.D.				

† DuPont Trademark.

Materials and sizes listed above represent the most widely used forms of slit electrical insulation. However, the scope of INMANCO's facilities offers many other variations, such as special put-ups, materials, and windings. INMANCO slit coils are made from nationally recognized products or from material which you supply. This, together with a specialist's "know-how," assures you of uniform, hard coils with smooth edges and precision tolerances.

Big orders, small ones, special tolerances, unusual slitting jobs—INMANCO engineers and facilities can give you exactly what the job requires.

WRITE FOR BULLETIN 33

Made by Inmanco® DIVISION

INSULATION MANUFACTURERS CORPORATION

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Branch Offices, Representatives, and Distributors in Principal Cities

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Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Avenue, Libertyville, Illinois, July, 1961
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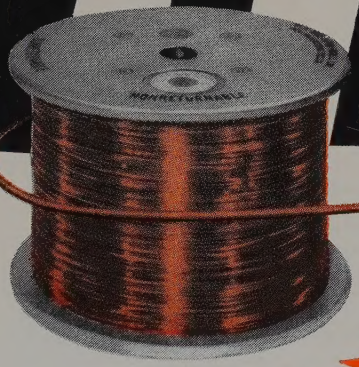
Advertising Sales Offices: See page 84.

Standardize with this multi-purpose film wire success!

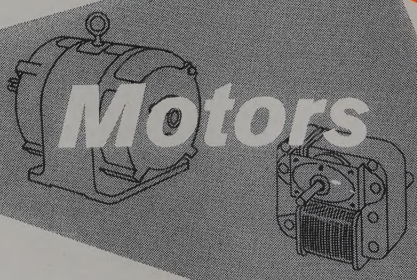
Phelps Dodge

POLY-Therm



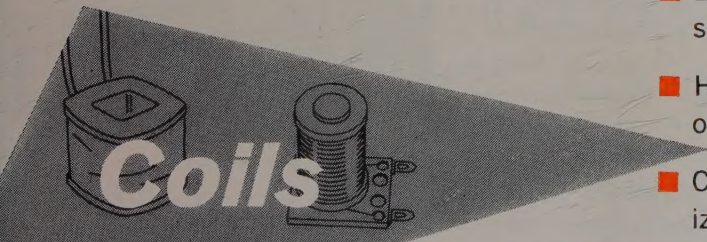
Has replaced as many as six standard wires in these important applications!

Motors



Poly-Thermaleze®—Patent applied for.

...aleze®



- Best balance of overall properties without sacrifice of any one property!
- High dielectric for thermal protection at operating temperatures (Class F 155C)!
- Cost reduction benefits through standardizing inventory to one wire for most applications!

Any time your problem is magnet wire, consult Phelps Dodge for the quickest, surest answer!

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From the Editor

Opinions and Rambling Thoughts

Every month we are tempted to sound off on issues which have nothing to do with the electrical/electronic insulation field but we restrain ourselves to deal with topics which are closer to home. You may even have noticed that we exercised remarkable restraint in not saying a word about the recent price-fixing situation in the electrical industry—we just figured that since every other editor in the country had covered the subject thoroughly, our comments would merely be adding to the bedlam (even though our egos make us suspect ours would have been the one clear voice in the wilderness).

However, we feel that our noble restraint in other issues entitles us to an occasional column devoted to comments and opinions on a hodgepodge of both insulation and non-insulation subjects. So here goes . . .

As soon as Commander Alan Shepard successfully completed his flight into space, we were deluged with news releases from various firms announcing that their products had accompanied the astronaut on his flight. Based on the number of such announcements we received and read elsewhere, we suspect that Commander Shepard must have made a couple dozen trips in a capsule that was much bigger than reported in order to take all of these products with him. We resisted the temptation to put out a news release of our own announcing that he had relaxed during his flight by reading *Insulation*—anyway, we thought that Life magazine probably had an inside track on such an announcement.

In *Insulation Forum* in this issue you'll see some comments from other readers regarding commercial exhibits at the Electrical Insulation Conference. These comments bring two points to mind. First, high calibre commercial exhibits as well as a high calibre technical program are vital to a successful conference. At times we get the impression that some people are almost apologetic or ashamed about the inclusion of commercial exhibits because of a feeling that only the technical program attracts attendance of insulation users so that the technical program is being used as an excuse for questionable commercial purposes. Our opinion is that commercial purposes are not questionable and that exhibits are welcomed by insulation users attending the conference just as the insulation users reading this magazine welcome good, informative advertising in addition to the editorial content. The second point we'd like to make is that there is no need to apologize for the attendance of a high number of insulation producer personnel at the Electrical Insulation Conference—insulation users look forward to the opportunity of meeting these men if they are technically competent.

As long as we are talking about conventions, we'll mention the very competent job always performed by WESCON (Western Electronic Show and Convention). The latest WESCON effort which we were pleased to see was a small folder explaining the purpose of WESCON and which calls for gentlemen's agreements on personnel recruiting and customer entertaining. The policies set forth in the folder are reasonable, diplomatic, and straightforward—it is encouraging to see such matters brought out in the open.

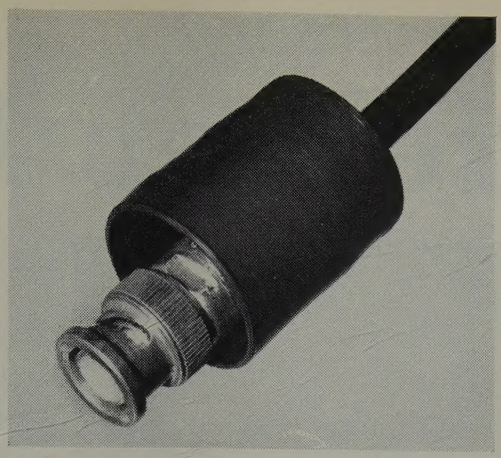
Chrysler Corp. sent us a nice, unobjectionable news release on air conditioners for Dodge cars but with it they enclosed the accompanying photo. We imagine that their air conditioners provide a lot of cool air. We also think that their model is dressed (there is probably a better word) to remain cool. But we strongly suspect

that the air conditioner is not big enough to counter the effects of the model if both are installed in cars of male drivers.

The U. S. Department of Commerce sent us this photo of one of their travelling exhibits of trade publications which appear at trade fairs

throughout the world. They said the photo included a copy of *Insulation* but after straining our eyes all week in an attempt to find it, we've decided *Insulation* must be buried under a copy of the Widget Makers Gazette.

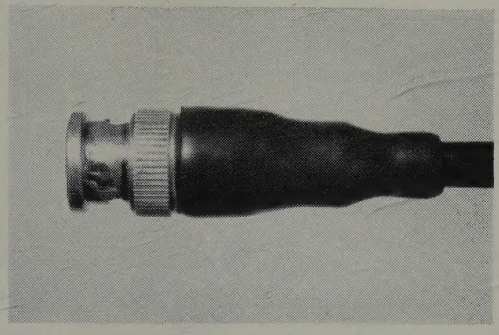
There has been a considerable amount of news lately on various methods of removing the salt from salt water to make it useful for drinking purposes. After examining the costs of all these projects and methods, we've decided it would be far simpler to develop a pill which could be swallowed by the drinker to make the salt water taste better and not produce harmful effects.



TYPICAL BOOT IN POSITION

MOISTURE-PROOF

AFTER 8 SECONDS AT 275° F



heat shrinkable

BOOTS...

FOR MOISTURE-PROOFING CONNECTORS

THERMOFIT®

Heat-shrinkable Thermofit® boots used in conjunction with Rayclad adhesive provides a moisture-proof seal at the point where a coaxial cable enters the connector. This completely eliminates moisture wicking and consequent loss of insulation values and dielectric strength. Thermofit® boots are supplied in an expanded form which permits easy installation after the connector assembly is completed. Exposure for a few seconds to heat in excess of 250°F. then shrinks the boot tightly into place.

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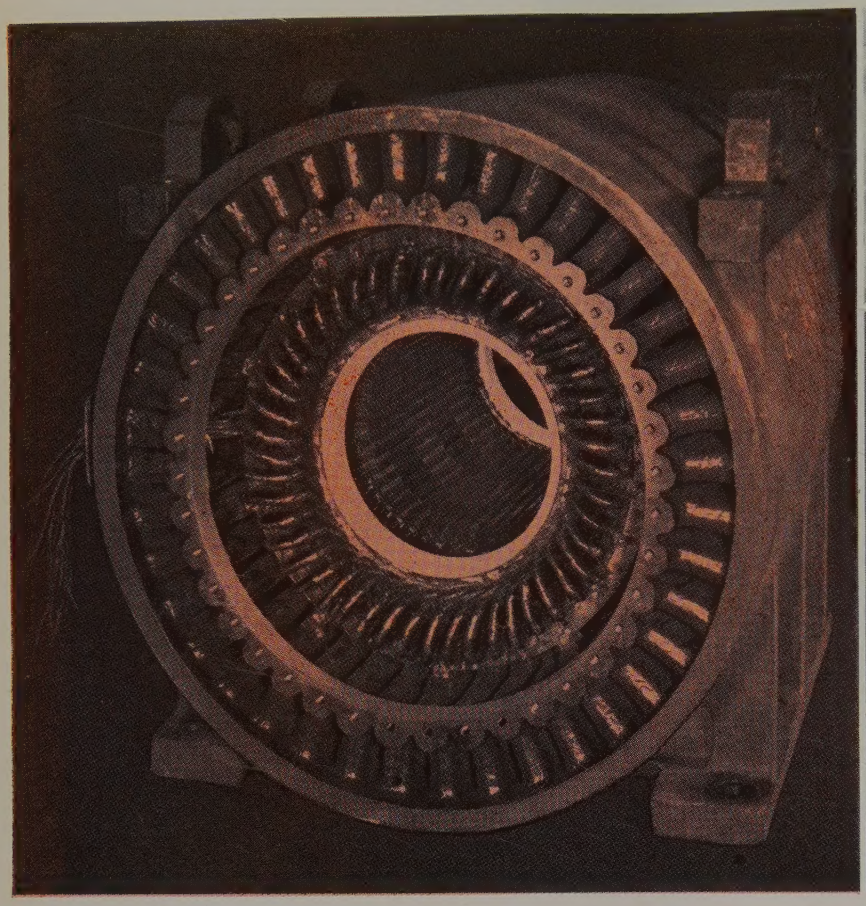

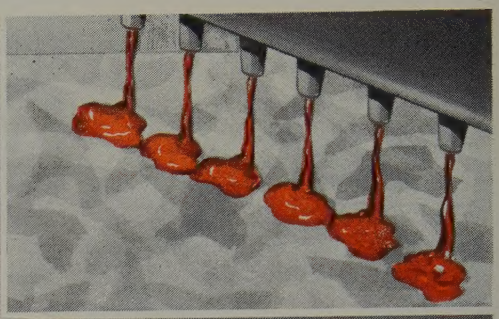

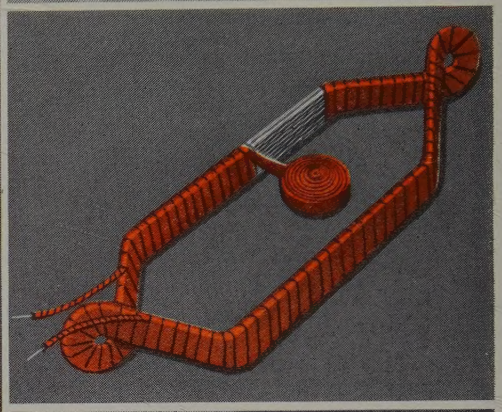

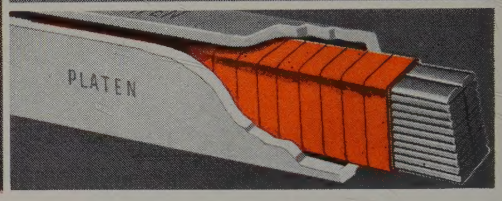

Westinghouse Uses Dow Corning Silicones for Thermalastic "H"

Dow Corning solventless silicone resins are excellent dielectrics . . . have high bonding strength. When cured, they form tough, void-free, heat-stable insulating materials.

Westinghouse, for example, uses Dow Corning solventless silicone resin as a bonding agent and filling material between the overlapping mica splittings of their Thermalastic "H" insulation system. Thermalastic "H" is used by Westinghouse to extend the advantages of Class H insulation systems into large rotating equipment of all voltage ratings including 13.8, 16.5, and 18 KV.

Similar in basic construction to the Thermalastic insulation system introduced by Westinghouse in 1949, Thermalastic "H" utilizes the inherent thermal properties and intrinsic dielectric strength of mica and solventless silicone resin. The high degree of fill achieved by vacuum-pressure impregnating glass cloth and mica splittings with solventless silicone resin assures a void-free insulation unequaled in voltage endurance, low power factor, outstanding resistance to heat, moisture and other contaminants.

The top illustration shows large mica splittings on a fiber glass backing being coated and filled with solventless silicone resin. Next, another layer of glass fiber is added and the laminate is then cut into tape. The tape is used to lap wind the coils. A solventless silicone resin is then introduced by vacuum-pressure impregnation and the entire coil form is heat-cured. The resulting insulation system easily handles Class H temperatures.

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Dow Corning is your best source for information and technical service on silicones.

first in silicones

Dow Corning

...Specify Silicones

To Silence Solenoid Valve

General Controls Company of Glendale, Calif., immerses the operating mechanism of their Dial-A-Flow gas valve in Dow Corning 200 Fluid. Result: the viscous fluid cushions the snap action of the mechanism, and makes it silent. The undesirable "pop" of gas ignition and noise of plunger impact are eliminated. Silicone fluid is the ideal damping medium because it doesn't thicken or thin with temperature changes, has excellent dielectric properties, is resistant to oxidation and to breakdown under shear.

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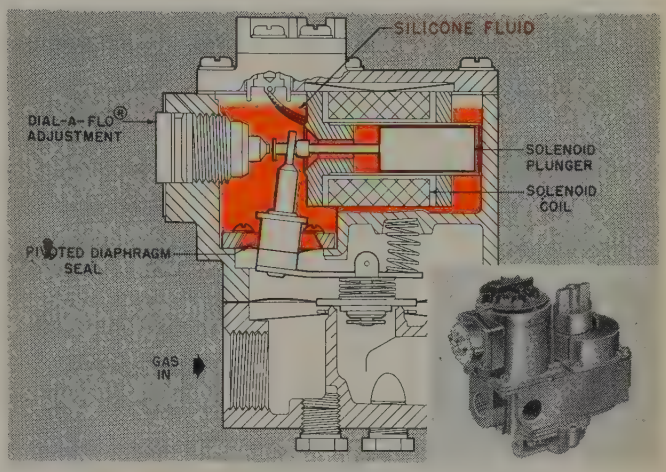
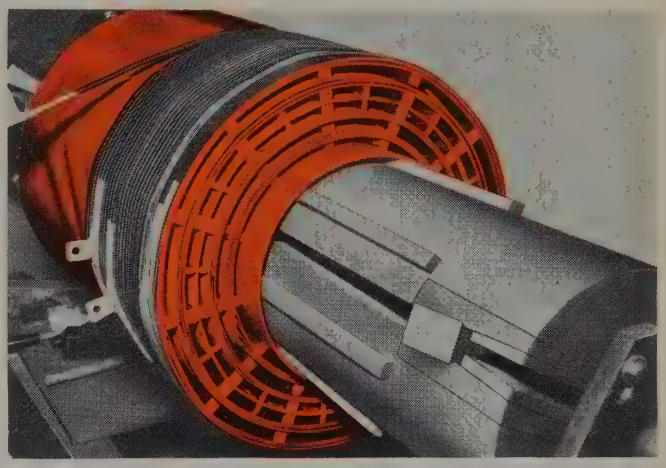


To Assure Reliability

Dependable performance of Class H unit-substation transformers is assured by I-T-E Circuit Breaker Company through specifying silicone-glass laminates for spacer strips, for support cylinders, for insulating diaphragms between secondary and primary windings, and for interphase barriers. Bonded with heat-stable Dow Corning silicone resins, glass laminates have high arc resistance, low loss factor, low moisture absorption . . . excellent mechanical and dielectric strength even after prolonged aging at 250 C. Used with other silicone insulating components, glass laminates permit smaller, lighter weight transformers that are easier to install and maintain.

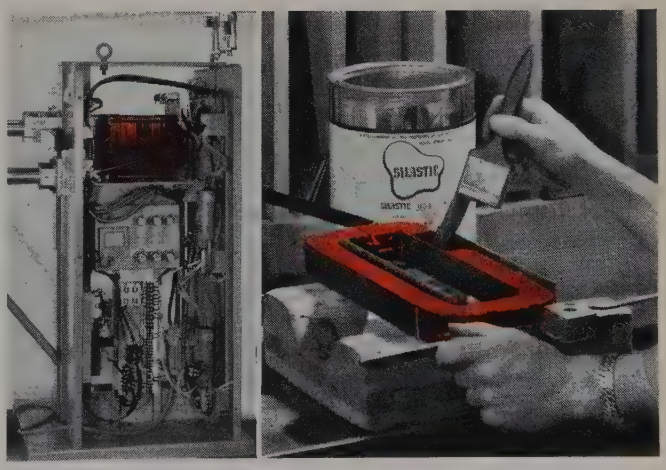
Print Ins. 6C on Reader Service Card



To Increase Welder Output

Peer Incorporated, Benton Harbor, Michigan, redesigned their welding equipment to take full advantage of the benefits offered by Dow Corning Silicones. Results: Power factor improved between 15 and 20% over conventional welders; transformer size reduced about 30%; interwinding breakdown raised to over 4000 volts; built-in protection against inadvertent abuse that would damage Class A and B insulation systems. More important, since redesigning with silicones, not a single Peer "300" Welder has failed for any reason. Basic to this remarkable insulation system is Silastic®, the Dow Corning silicone rubber, shown being applied to a transformer coil.

Print Ins. 6D on Reader Service Card



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Dow Corning Executive Heads Golden Omega Award Selection Committee

Shailer L. Bass, executive vice president of Dow Corning Corp., Midland, Mich., silicones producer, has accepted the chairmanship of the *Golden Omega* Award Selection Committee for the 1961-62 period. The *Golden Omega* award, sponsored by *Insulation*, is awarded at each Electrical Insulation Conference to an outstanding leader whose accomplishments have figured significantly in the technological progress of this country. The purpose of the award is to provide national recognition for exceptional achievements, efforts, and technological contributions without regard to scientific field. Because of its broadness, the award has special significance, importance, and stature on a national scale.

The award was first presented at the 1959 conference to Vice Admiral Hyman Rickover who figured prominently in the development of the nuclear ship program in the United States. In 1960 the award went to Dr. Mervin J. Kelly, former head of the Bell Telephone Laboratories, who had much to do with the development of the transistor.

Other nationally known industrial leaders will soon be named to the Award Selection Committee to assist Dr. Bass in the selection of another worthy recipient who will be honored at the next Electrical Insulation Conference to be held the week of February 18th, 1962, at the Shoreham Hotel, Washington, D. C. The Award Selection Committee will also be assisted by a working group headed by W. G. Hoffer, manager, electrical equipment sales department, Dutch Brand Division, Johns-Manville Corp., and chairman of last year's Electrical Insulation Conference.

1000°F Magnet Wire

New product news this month includes a report by General Cable Corp. claiming the first practical, flexible, reliable magnet wire for 1000°F service. Use of the ceramic insulated wire is described in terms of motors that glow in the dark and relays at work in the heart of a flame.

More Cooperation on Polypropylene

Of late there is no bashfulness on the part of plastics raw materials companies when it comes to joining forces on the sales front. A notable example was the recent double arrangement between Union Carbide Plastics Co. and Shell Chemical Co. which provides both firms with complete lines of polyethylene and polypropylene. The latest agreement is one between W. R. Grace & Co. and Chemore Corp., general representative in the United States for Montecatini, Milan, Italy, to cooperate in the marketing of polypropylene. The polypropylene, which has numerous electrical and other applications, is to be produced at a Montecatini subsidiary plant in the United States, and will be marketed by both Grace and Chemore. Present products of Grace include polyethylene and polystyrene.

Also, Du Pont has now announced that it is doing market development work on polypropylene resin. The company is producing some polypropylene in a pilot plant but plans to obtain most of the additional material it needs from Hercules Powder Company, one of the original producers. According to Roy L. Schuyler, director of the Polyolefins Division of Du Pont, it is quite likely that before long the division's research program will develop completely new polyolefin polymers.

Pilot Plant for New Du Pont Electrical Insulation Fiber

Du Pont is in the process of constructing a pilot plant for the production of a new fiber, designated HT-1. It is described as a high temperature resistant polyamide which reportedly shows great promise for electrical insulation and other uses. The plant is scheduled to be completed late in 1962. The new HT-1 fiber is said to be the product of more than 12 years of research.

Du Pont Plastics News

The Du Pont Co. has announced that it will build a new plant at Orange, Texas to produce high-pressure polyethylene and a new product, "Elvax" vinyl resin, a copolymer of ethylene and vinyl acetate. The new polyethylene unit will bring Du Pont's polyethylene capacity to nearly 400-million pounds and is but the latest in a long list of polyethylene plant expansions and additions announced by the major producers. The new vinyl resins are said to impart toughness, flexibility, and adhesion to paraffin wax and other brittle low molecular weight materials.

Du Pont, in another move, has reduced the prices of polyester fiber by 7 to 17 cents a pound and nylon by 4 to 15 cents a pound. Only the staple fiber types were affected.

The term "Tedlar" is being substituted for "Teslar" as the trademark for Du Pont's new polyvinyl fluoride film which is claimed to have outstanding weatherability, toughness, chemical inertness, and electrical insulating properties. The change is designed to avoid possible confusion with an already existing mark. The film is now produced only in pilot plant quantities but a plant for commercial production is expected to be on stream in the middle of next year.

Pixilated Patents

By Mike Rivise

Fifty-fifth in a series of odd and interesting inventions in the electronics field from the files of the U. S. Patent Office.

After years of thinking of sweaty feet only as a definite social disadvantage, we have finally come across a suggestion for putting this offensive characteristic to some good use. Way back in 1869, Caleb V. Littlepage of Austin, Texas, developed a method of utilizing the perspiration given off by human feet to produce a galvanic current which in turn would keep the feet warm. The galvanic current was also expected to provide other health aids as explained in the following description of the invention taken from patent 103,061 dated May 17, 1870:

"It is found by practical experiment that a small voltaic pair of plates of zinc and copper, or other suitable metal worn in the shoe, will, by the chemical action of the acid arising from the perspiration, generate galvanic currents, which, being given off to the feet, will intensify the circulation, and warm and invigorate the feet, lower limbs, and other parts of the body; and I therefore propose to make use of such batteries in this way for the purpose of warming the feet in cold weather.

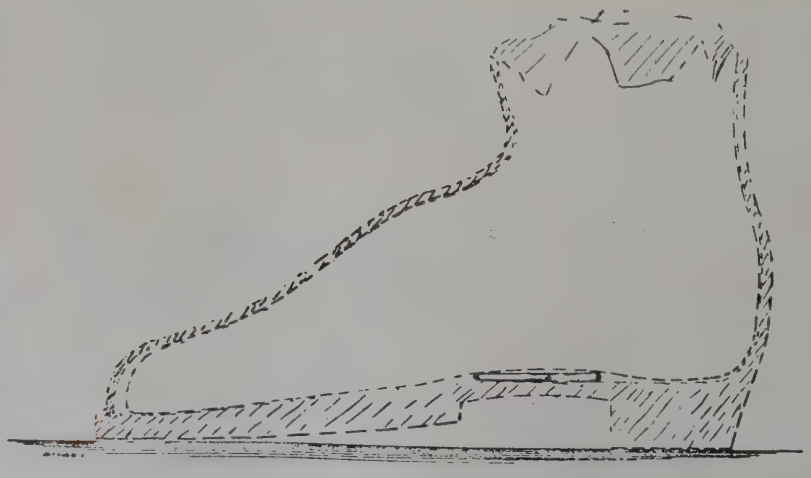
"I cover them on one side with thin cloth, or other substance, to prevent the feet from direct contact with the metal, and I use them either under the stocking or inside of it, and at the hollow part between the heel and the ball.

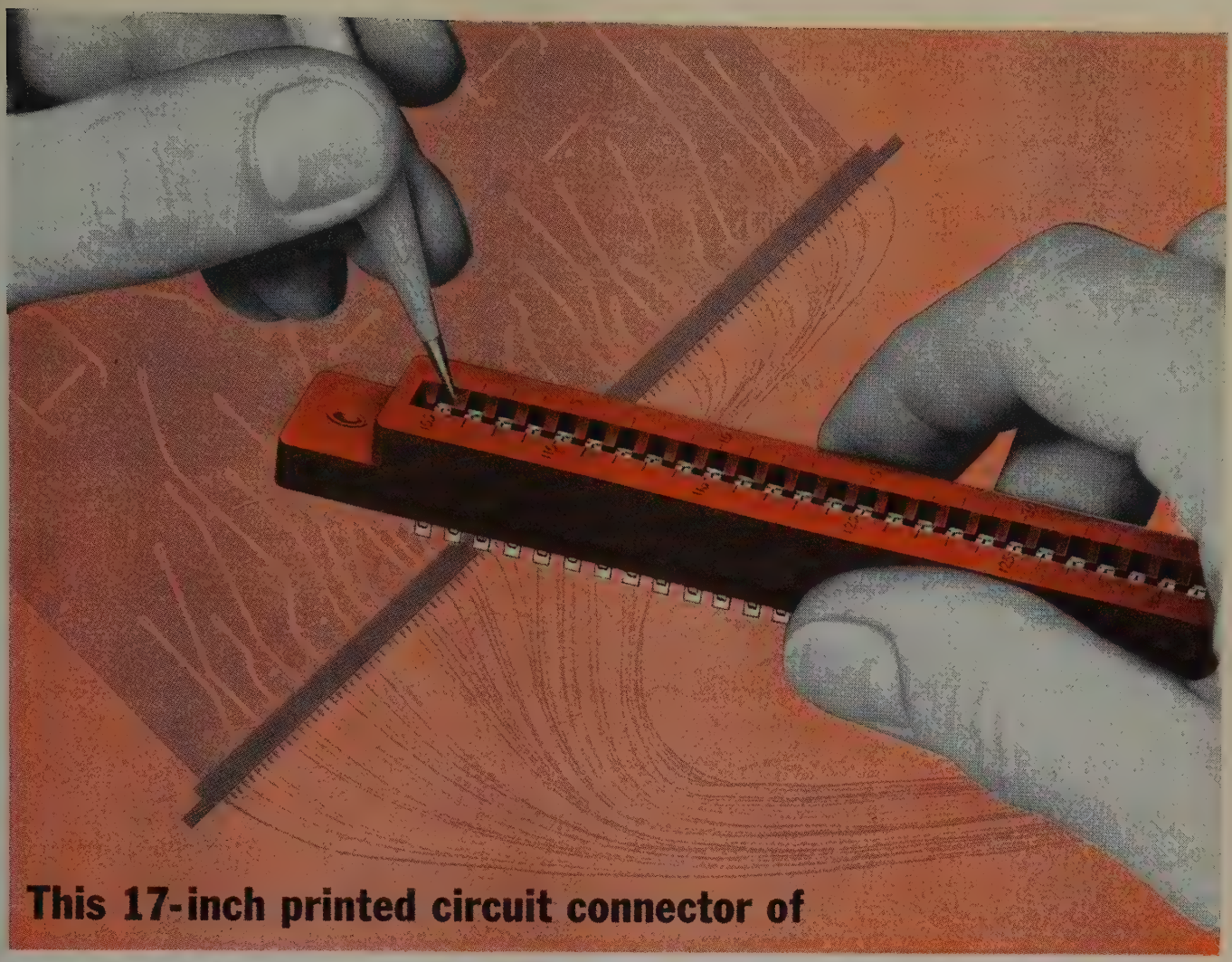
"I have found that, when worn in this way, intermittent currents will be given off to the feet and legs, as the connections of the feet with the plates are closed and broken in walking.

"The strength of the currents may be varied by varying the size of the plates or number in the battery.

"Either zinc or copper plates may be worn uppermost, and good results may be obtained by wearing one of each kind uppermost or against the foot.

"In making these plates, I connect them together by turning the edge of one over the other, and, at the same time, secure the cloth covering by folding the edge thereof under the edge of the plate turned over."





DAPON® M OPERATES AT 450° F... STOPS WARPAGE AND MISALIGNMENT

DIALLYL ISOPHTHALATE

Dimensional stability of compounds based on DAPON M keeps this connector straight and true: contacts are always accurately positioned.

This long connector is home base for hundreds of terminals. By molding it of thermosetting compound based on DAPON M, Viking Industries Inc. solved a number of design problems . . .

DAPON M gives the connector outstanding electrical and mechanical qualities. The resin permits 450°F continuous operating temperatures, has excellent dimensional stability and resistance to moisture. Its electrical resistance (measured in millions of megohms) remains unaffected by weeks of exposure to 100% relative humidity.

The material is easily molded. It has good hot strength, the piece is strong when cured. Neither cooling jigs nor multiple ejector pins are needed in removing the connector from the mold. Fast cycles are possible. The resin's high flex, tensile, and compressive strengths result in rugged moldings with high insert holding power and dependable performance.

DAPON M is recommended for use wherever:

- high operating temperatures are encountered
- top electrical qualities are a must
- better strengths are desired
- molding conditions pose a problem.

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European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Ill.

•

In the monthly journal of Siemens Ltd. (West Germany), Vol. 35, No. 4, April 1961, there are some interesting articles concerning new techniques and applications of insulating materials.

Welding the Polyethylene Sheaths of Communication Cables

By E. Kraus, pp. 251-252. Original title: "Schweissen der Polyäthylen-Mäntel von Nachrichtenkabeln."

The usual methods of welding polyethylene sheaths and sockets, i.e., by high-frequency welding and gas welding, are very suitable in practice, except in the case of erection on site owing to the great amount of equipment needed. In this article a kind of portable, plastic, pressure-gun is described. The welding material is fused into the plastic state by an internal flame. The welding speed is approximately 10 cm/min, depending on the wall thickness.

A Low Oil-Content Expansion Circuit Breaker, Series 10, with a Higher Interruption Rate

By G. Homp, pp. 263. Original title: "Oelarme Expansionsschalter der Reihe 10 mit höherer Ausschaltleistung."

An epoxy molding resin was used for the arcing chambers. The easy molding of this resin gives many advantages in construction over the usual porcelain insulator. The solid molding was provided with ribs to enlarge the creeping distance, and the fixing screws were molded directly into the resin. Besides its high impact strength and mechanical strength, molded resin is also resistant to arcing.

Indoor Disconnecting Switches (Series 10-30 kv) According to New Specifications, Using Molded Resin Insulation

By E. Hartmann, pp. 283. Original

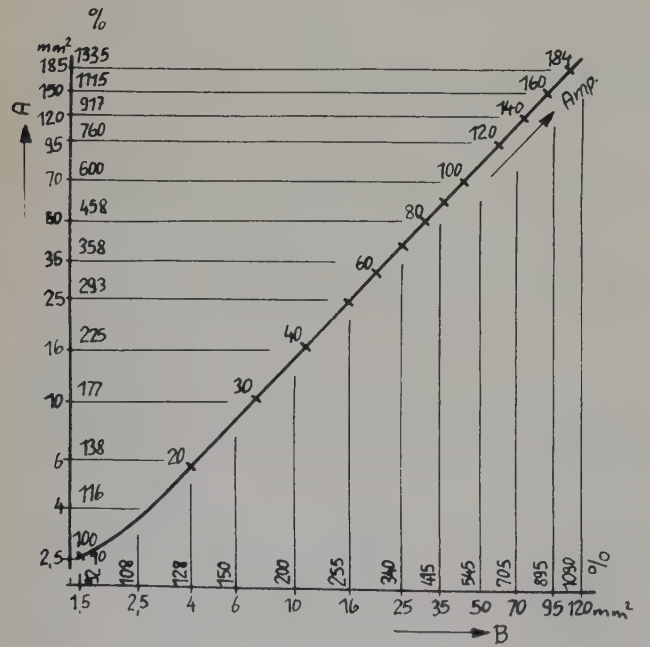

Figure 1, comparison between conductor cross-sections using natural rubber insulation (A) and butyl rubber insulation (B) and the relative price (%) for a given loading of the cable (amp). Example: For a loading of 135 amp, it is necessary to use a cable 3 x 120 mm² (natural rubber)—relative price 917—or a cable 3 x 70 mm² (butyl rubber)—relative price 705. Refer to page 17.

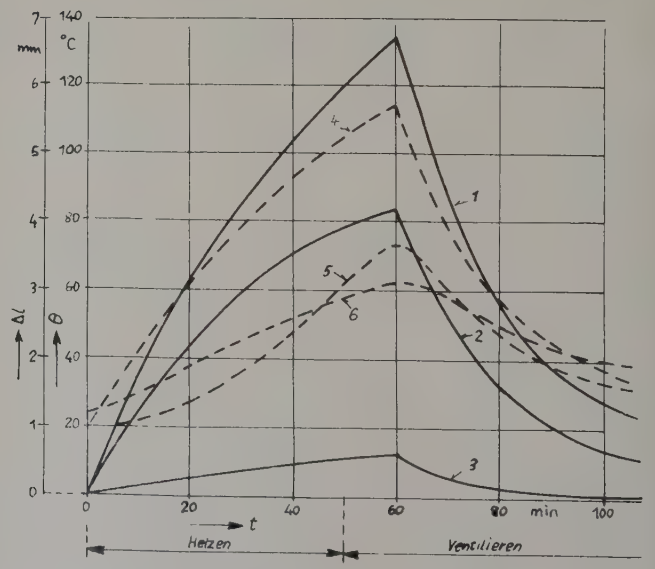

Figure 2, example of a temperature cycle on a test-bar insulated with asphalt/mica. t = time (minutes); θ = temperature (°C), l = change in length (millimeters). Curves represented are: 1) Change in length of copper; 2) Change in length of insulation; 3) Change in length of stator iron; 4) Mean copper temperature; 5) Mean temperature in the center of a stator tooth; 6) Temperature at the base of the slot. Refer to page 17.

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Essex Magnet Wires produced for the hermetic motor industry are an example of the complete wire line developed specifically for your applications. There is a "right wire" for you in the full Essex line.

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Class 105C	Class 105C	Class 105C	Class 105C	Class 105C	Class 105C	Class 105C	Class 105C	Class 105C	Class 130C	Class 105C	Class 130C	Class 155C	Class 180C	Class 220C
Plain or Black Enamel	Formvar	Acrylex	Formetex	Bondex	Nylon	Nyform	Soderex	Gripex	Soderon	Soderbond Soderbond N	Epoxy	Poly-Thermalex Nytherm Thermalex F	Silicone	Allex

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A urethane modified Formvar wire developed for the hermetic motor industry. This construction offers improved chemical stability in R12 and R22 refrigerants, plus greater resistance to thermoplastic flow when compared to unmodified Formvar. This has been accomplished without sacrifice of the characteristics associated with the vinyl acetal wires. Available in round wire sizes AWG 12 thru 27 in single, heavy and triple builds and in shaped wire up to 100,000 square mil cross section.

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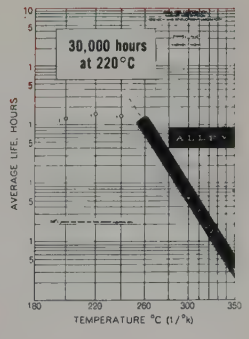

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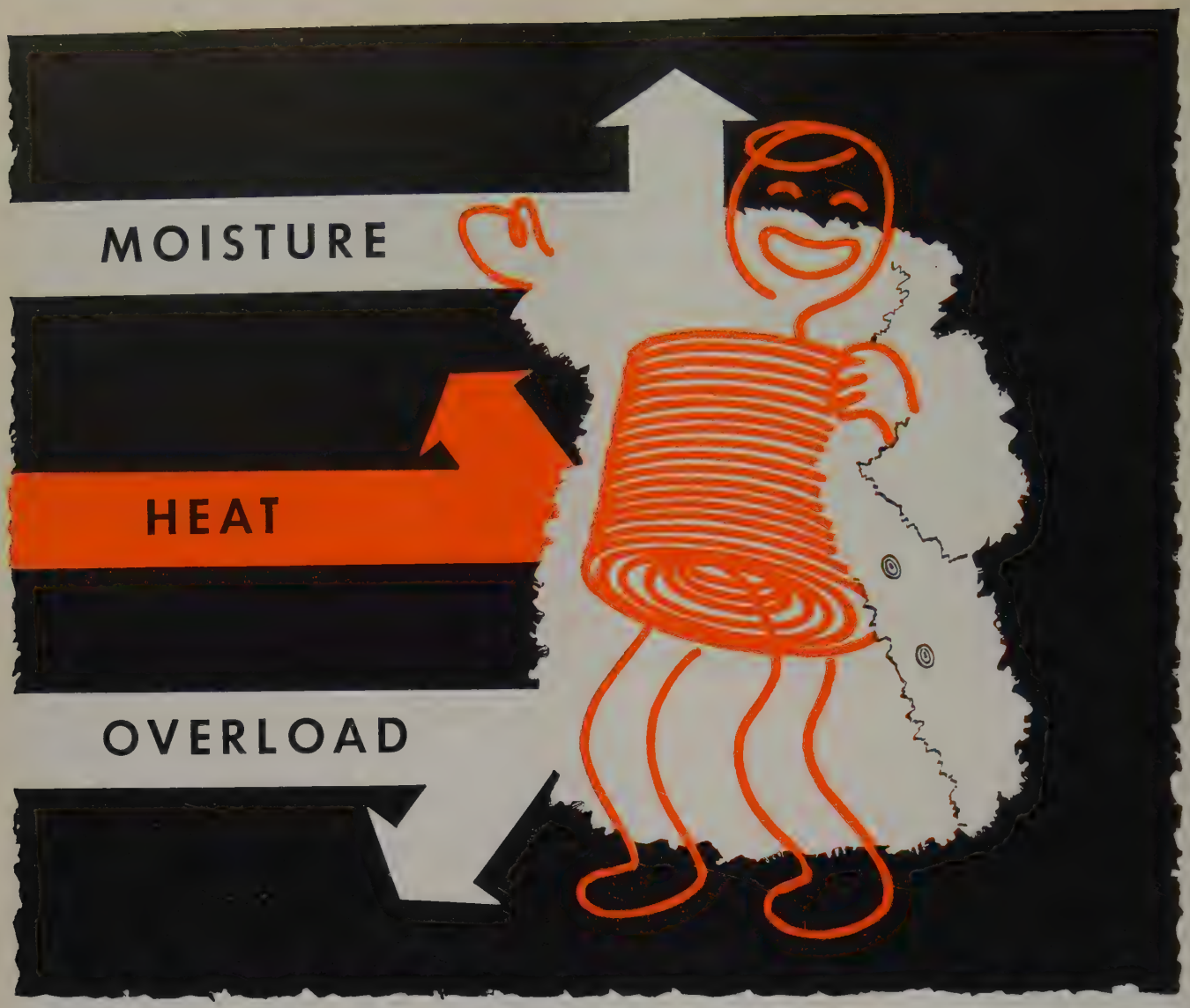

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title: "Innenraumtemperatur (Reihen 10 bis 30) nach neuer Norm mit Giessharzisolierung."

The range of disconnecting switches has been adapted to the latest regulations of the International Electrical Commission (IEC). The support insulators and other insulator pieces are made from molded resin and all insulators are ribbed to reduce the danger of flashover due to surface contamination. These new insulators are also strongly resistant to short-circuit arcs.

Advantages of Ships' Cables with Butyl Rubber Insulation

By H. Hübner, pp. 286-287. Original title: "Vorzüge der Schiffkabel mit Butylkautschuk-Isolierung."

Normal Lloyds regulations give a working temperature of 80°C for a ship's cable insulated with butyl rubber. Because of this, it has become possible to use a smaller copper cross-section, since when using a mixture of natural rubber and a varnished fiber tape, the working temperature permitted is only 60°C.

An example has been given in the appendix (figure 1), which shows clearly the economies which can be obtained together with a technical improvement by means of the better copper utilization in butyl rubber insulated cables.

Insulation Materials for Indoor High-Tension Installation

By R. Haldimann and E. Richon in Bulletin des schweizerischen elektrotechnischen Vereins, Vol. 52, No. 4, February 1961, pp. 121-126. Original title: "Isoliermaterial für Hochspannungs-Innenraumanlagen." Both authors are with E. Haefely & Co. AG. Basle, Switzerland.

Wall-Bushings

For protection against moisture and contamination a porcelain cover is not very suitable, especially when the bushings are also mechanically stressed (e.g. as in a rotaary disconnecting switch). In order to make compressed-paper bushings withstand these conditions coatings are needed, which are unaffected by either moisture or contamination. The authors have had more than five years' satisfactory operating experience using layers of epoxy-glass bandage.

It is also recommended that the compressed-paper bodies be molded with epoxy. The mechanical and arcing strengths are better than those of porcelain covers. The adhesive and tearing strengths were investigated in tests during a fall in temperature from 80°C to 0°C, following storage in air of 93% relative humidity. The insertion of acetylized paper also gave good results, in spite of the normal cresol resin.

The cost of these various bushings varies considerably. An epoxy molding raises the price by approximately 15%, an epoxy resin binding by 25-35%, a porcelain cover 80-90%, and acetylized paper 60-110%. Through the use of epoxy, i.e. bushings molded from epoxy instead of cresol, the cost is still higher.

Supporting Insulators.

Supports can be made from molded epoxy-resin, interspersed with a quartz filler. Any bending quality can be regulated by forming and filling in the desired proportions. Smooth unribbed insulators are very suitable for dry and moist indoor installations. Epoxy-resin supports have a smaller weight and volume, a better breaking strength, and a larger flashover arc strength than porcelain insulators.

Insulated Bus-Bars.

For a rated voltage not exceeding 30 kv, the normal insulation methods used for generator windings (e.g. mica paper-epoxy insulation) are sufficient. For higher voltages (e.g. 60 kv), freedom from ionization is not enough, and consideration must also be given to the removal of heat, both from a long bar and during overload conditions. The authors propose an oil-paper insulation as the best solution to the problem.

Aging Tests for the Development and Assessment of New Stator Insulations

By K. Abegg in Bulletin des schweizerischen elektrotechnischen Vereins, Vol. 51, No. 18, September 1960, pp. 849-856. Original title: "Alterungsversuche zur Entwicklung und Beurteilung neuer Stator-Isolationen." K. Abegg is with Maschinenfabric Oerlikon, Zürich, Switzerland.

The author divides into two categories experiments concerned with accelerating the aging of stator winding insulation, especially in large generators:

a) Large experiments using an exact lay-out with, when possible, all aging parameters (temperature, thermo-mechanical stress, voltage, etc.) arranged to give reality to the corresponding model.

b) Small experiments in which only a single condition is investigated.

The classic large experiment is a test on insulated bars in a stator segment. In the article, a test segment having an iron length of 3.5 meters and 5 slots, each containing 2 bars, is described. The effect of the following parameters is investigated: temperature, thermo-mechanical stress (temperature cycles), and ionization.

The thermo-mechanical stresses and temperature cycles for a class B insulation (asphalt/mica) are shown in figure 2. The author stresses the insulation with its rated voltage but at a possibly higher frequency (500-1000 c/s).

The following measurements and observations are made for control during the tests on an insulation: geometrical variations (lengthening, swelling), tan δ as a function of the voltage, the onset of corona, measurements using 500-1000 v d-c, the d-c voltage as a function of the high voltage (a-c), and various temperatures.

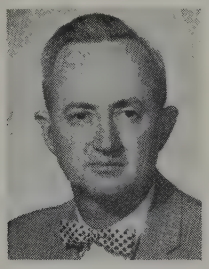
As small experiments, the author describes tests with corresponding thermal and electrical stresses on 600 mm long test bars, which are possibly even cut from test bars aged in a stator model; aging curves for test bars (i.e., time until breakdown as a function of voltage); and corona investigations on flat plates of the material in the so-called "French" cell (see an article by F. O. Wohlfahrt in *Insulation*, December 1960, pp. 76).

For aging tests an oven temperature of 20-40°C over the hot-spot temperature and rated voltage at a frequency from 900-1000 c/s is proposed. The control measurements are the same as in the large experiments.

Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

In what way have exhibits at any of the past National Electrical Insulation Conferences (1st, 2nd, and 3rd National Conference on the Application of Electrical Insulation) been helpful to you, and do you think the exhibits at the next conference might be improved . . . if so, how?



J. A. Bell

Engineering Dept., Electro-Motive Div., General Motors Corp., La-Grange, Ill.

"To my group (insulation engineers at Electro-Motive) the exhibits have been very important. We not only see many new materials, but we can observe the application that other users make of these materials. From these various applications we have gotten many new ideas on an application to our own product.

"Also, most of the exhibits are attended by technicians, and we are able to discuss our application with them firsthand instead of waiting for a visit from them at a later date. (I could give you quite a long list of materials and applications we have gotten from such exhibits.)

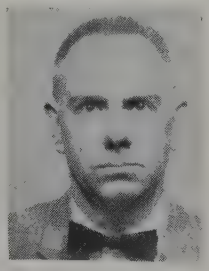
"As to improving the exhibits—it would be difficult to make a recommendation. The manufacturers of electrical insulation, I'm sure, wish to cover the entire field of electrical apparatus which is varied and wide. They cannot cater to one particular phase such as the manufacture of "heavy duty, high temperature equipment," but must cover the entire electrical field.

"I think the exhibits at the past three conferences have been excellent and have improved each year."

J. E. Koncel

Project Engineer, Insulation, Bodine Electric Co., Chicago.

"I believe that the exhibits at all of the past National Electrical Insulation Conferences have been helpful in that they were able to present firsthand to all those in attendance the many new materials reaching the insulation market. For a user of insulation materials, this is a wonderful opportunity to become acquainted with the very latest in insulation products. Being able to obtain further specific knowledge on a material of particular interest on an informal basis such as exists in the exhibit area is very worthwhile. As for improvement, about the only comment I might be able to add is that perhaps the 'hard' sell should be softened slightly."



L. L. Evitts

Materials & Processes Engineer, Century Electric Co., St. Louis, Mo.

"Considering the great number of insulating materials offered today, together with the number of things requiring insulation, and you have need for more ideas than anyone could get in 10 lifetimes. Here is where the E. I. show helps. I can get more ideas there in three days than in ten years at a desk. If something looks particularly good, one can usually find others of his own ilk, and together with the factory 'expert' give the idea a real treatment right on the spot. This show of interest, without delay, could prevent a noteworthy material from being withdrawn before user confidence develops. Costly loss of time and testing might be avoided simply by a few well placed questions to booth attendants and to unsuspecting insulation engineers found loitering there. It is imperative to learn any bad features of a material application as soon as possible.

"I find that a complete rearrangement of items on my testing agenda is necessary after attending these exhibits. In short, it is a most difficult task to assign priorities for testing incoming materials and ideas for their application. These exhibits help in that area also.

"I cannot offer any suggestions for improvement. Most of the booths seemed to be quite well done."

R. Christensen

Vice President, Engineering & Research Div., Skil Corp., Chicago.

"The exhibits in the past National Electrical Insulation Conferences have been helpful, generally, by bringing together a large number of samples, specifications, and cross-sectioned equipment models, showing a wide range of insulating materials for many applications. One of the most helpful aspects of the exhibits has been the opportunity to observe the

actual models of various types of equipment showing the use of the insulating materials. In many cases, the exhibits stimulate ideas for similar uses of insulation, or for totally different applications. I would suggest that a greater number of models of this type be used in conveying the insulation story in future exhibits."

F. Renner

Project Engineer, Hubbard-Kearney Electrical Research Laboratory, McCook, Ill.

"I have found the exhibits at the National Conference of great assistance to me. They have contributed towards better product design. The exhibits provide an annual opportunity to review *live* the insulating materials advertised and described in literature during the previous year. At a single meeting the opportunity is provided for me as a product design engineer to discuss and observe with competent exhibitors insulating materials and their applications.

"From the exhibits I have made numerous contacts with insulation suppliers that have proven beneficial. Possibly, these important contacts would not have been made without the exhibits.

"The Conference brings together the largest number of insulation suppliers and designers. Consequently, there is a mutual exchange of information that promotes better understanding of insulating material. The design engineer is made keenly aware of insulating material and its application. In short, the exhibits are an excellent refresher course in insulation materials and suppliers.

"Needless to say, I would like to see more manufacturers of insulation have exhibits at the conference. I would like to encourage the manufacturers to fortify their exhibits with increased representation of factory technical personnel. Lastly, I would like to call upon the ceramic suppliers to increase their participation."

Arthur E. Snowdon

Assistant Chief Engineer, The Superior Electric Co., Bristol, Conn.

"It is my opinion that exhibits at the Insulation Conference serve a useful purpose. I have found it very helpful to see and handle new materials either before or after they have been described and discussed during the technical meetings. In particular, at the 1960 conference I was interested in looking at samples of encapsulated motor stators and rotors, acrylic papers and tubing, and the silicone potting compounds.

"I think the exhibits should remain subordinate to the technical sessions. However, I feel they can be improved as follows:

1. Use attendants at the booths who are qualified technically to discuss their product and its use.
2. Make an effort to display new developments and especially include samples of any new material or process which is described at one of the technical meetings."

C. L. Craig

Senior Materials Engineer, Materials & Components Engineering, Sperry Gyroscope Co., Great Neck, N.Y.

"I have obtained up-to-date information on new insulation products and processes at all of the past conference exhibits. However, I believe the exhibits could be improved by less emphasis on 'gimmicks' and fancy backgrounds. If this effort were replaced by more displays of advanced technical applications, I believe more benefits would result. The producer's top technical personnel should be present and available for mutual interchange of information. Copies of any technical papers presented by the manufacturer's staff should be available for ready distribution."

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Hearing-Aid Mikes Assembled With Tiny Drops of Epoxy

Use of epoxy resin compounds for bonding has permitted a degree of miniaturization heretofore considered impossible in the manufacture of microphones used in hearing aids.

A new design approach, based on assembly with epoxy adhesives, has produced what may be the world's smallest component of its type.

Printing techniques are used to apply the epoxy compounds used in this assembly operation. The amounts of epoxy involved are as little as .002 inch in thickness.

The tiny microphones, which feature a balanced armature pickup and which can also be used as earphones, are manufactured by Dyna Magnetic Devices Inc., Hicksville, N. Y. The epoxy compounds used are formulated by Smooth-On Manufacturing Co., Jersey City, N. J.

The chief characteristics of epoxy compounds that led to their selection for use in the miniaturized assembly are high adhesion, low viscosity, stability, and completely predictable behavior.

Predictable behavior was essential in any material selected for bonding these highly miniaturized components because the slightest instability on the part of the bonding agent, or the slightest physical damage to the components during the bonding operation, could harm the electrical characteristics of the finished assembly.

Welding and rubber cement, traditional bonding methods, are still used in some instances in this assembly. But where no physical strain, no disturbance, no metal deformation, no changes in weight or temperature can be tolerated lest electrical characteristics be impaired, then epoxy resin compounds are used. The predictable behavior of these components permits strict adherence to design specifications regardless of how critical the operation.

Here are some examples of why this factor of predictable behavior is so important.

Because of the degree of miniaturization achieved, the adhesive material must occupy a tiny, specific area, and occupy it neatly. There can be no overlap into areas where it does not belong. There can be no excess material, no scraping, no removal of surplus.

At the same time the build-up of any adhesive material used must be within a specific range of thickness in view of the tight dimensional specifications. In the microphone the adhesive material cannot build up to a thickness greater than .007 inch, nor remain below .004 inch. Epoxies stay within this narrow .003 inch thickness range.

Stability of the bonding material is another essential. For example, one component in the microphone assembly, a vibrating member, is so sensitive that its travel is measured in millionths of an inch. The slightest physical change in the bonding material after its application could have serious impact on this tiny part.

Every drop of bonding material that goes into the microphone assembly must be carefully weighed and accounted for in terms of overall specifications. The weight of each drop at time of application must be virtually a "final" figure. Any significant change in weight later as a result of instability of the material means that the finished assembly will not meet specifications.

With the exception of a few instances in which welding or rubber cement are used, Dyna Magnetic relies on epoxies for virtually all aspects of this assembly operation. These include adhering magnets, bonding aluminum and plastic pieces that form the laminated diaphragm, and mounting a coil on a metal piece with clearance inside the coil.

Use of epoxy in the coil-mounting operation has not only made possible careful positioning of the coil without damage but has also contributed to elimination of a space consuming part. Prior to the use of epoxy here it was necessary to use a coil bobbin. Elimination of this part, of course, was a factor in miniaturization.

Figure 1, photograph demonstrates what epoxy has accomplished in the way of greater miniaturization. The speaker at the left is the smallest size that was possible when earlier bonding techniques were used. The smaller speaker at the right, assembled by use of minute quantities of epoxy resin compounds, is approximately 50% smaller than the earlier version.

Figure 2, coil mounting, one of the assembly operations in manufacture of miniaturized hearing-aid microphones. Here an epoxy bonding material has been mixed and is being used in minute quantities to bond the coil to the armature.

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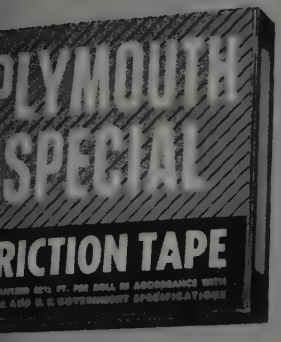

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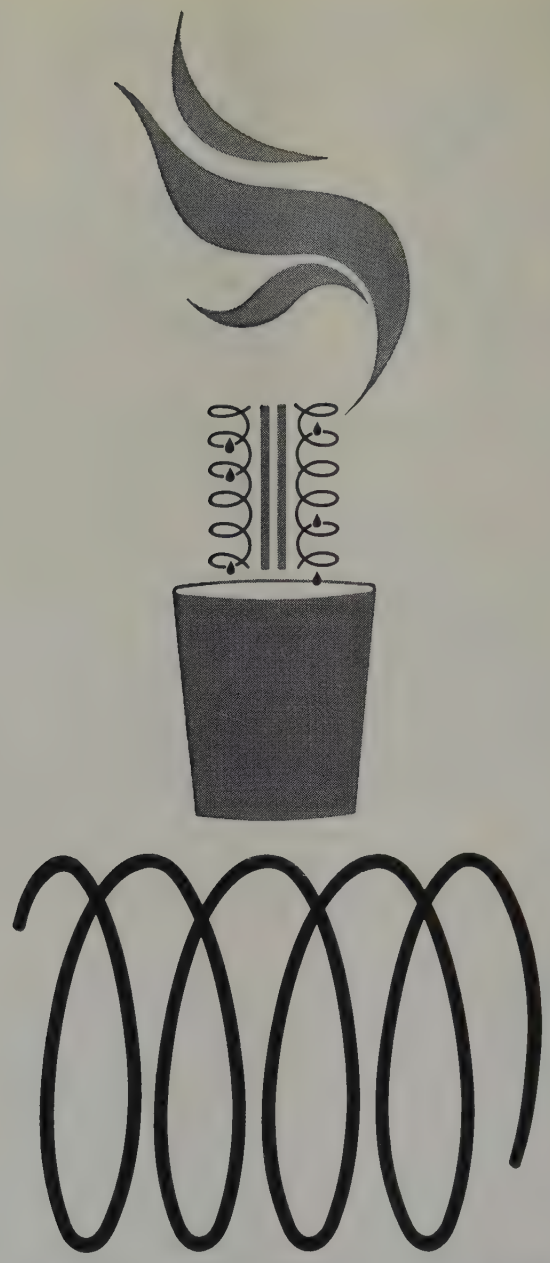

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CONFORMS TO NEMA AND MIL SPECS. Anatherm-D magnet wire meets all requirements of Spec MIL-W-583B for Class 155 Types L, L2, L3, and L4. It's available in all sizes of round, square and rectangular, with single, heavy, triple and quadruple film additions, all conforming with NEMA specifications. Anatherm-D is available in all standard Anaconda packages: spools, pails, reels and drums. For prices, technical data and application information contact Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-I. 6137

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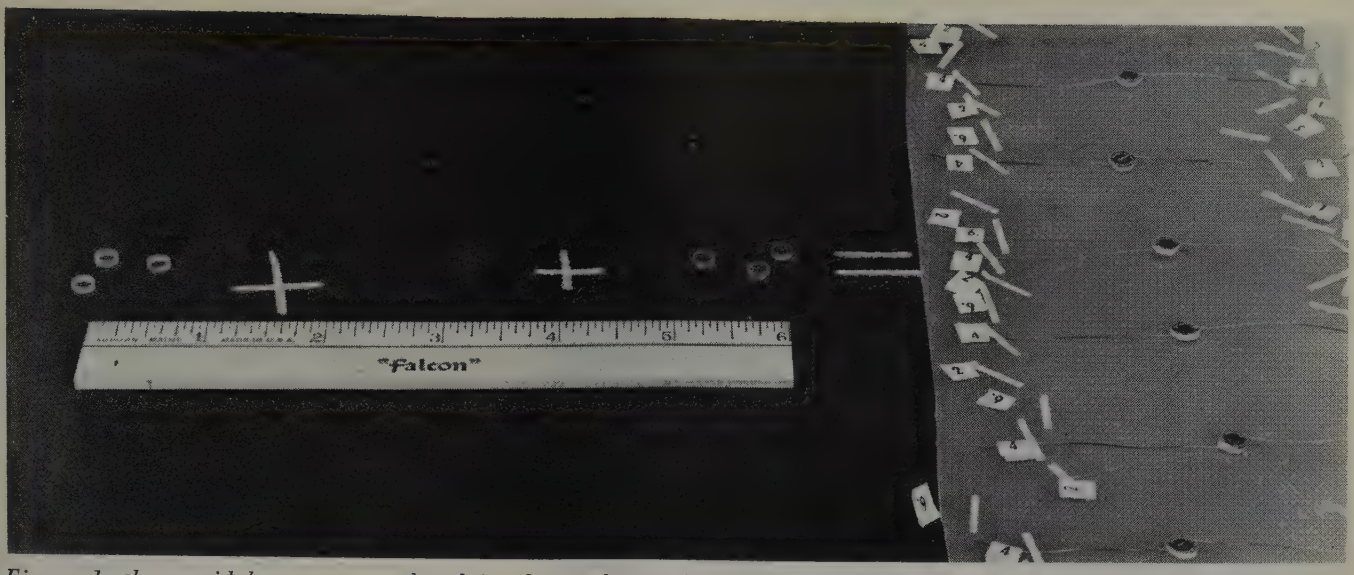

Figure 1, the toroidal cores were placed in plastic sleeves, before winding, to prevent the windings from distorting the magnetic core and to prevent the windings from developing shorts caused by the core cases' sharp edges. The cores used in the actual production run were supplied complete with plastic cases by the manufacturer.

Integrated Encapsulation Shortens Lead Time

By R. B. Feuchtbaum, Member of the Technical Staff, Hughes Aircraft Co., Culver City, Cal.

All photos courtesy Hughes Aircraft Co. and information disclosed therein is proprietary with Hughes Aircraft Co.

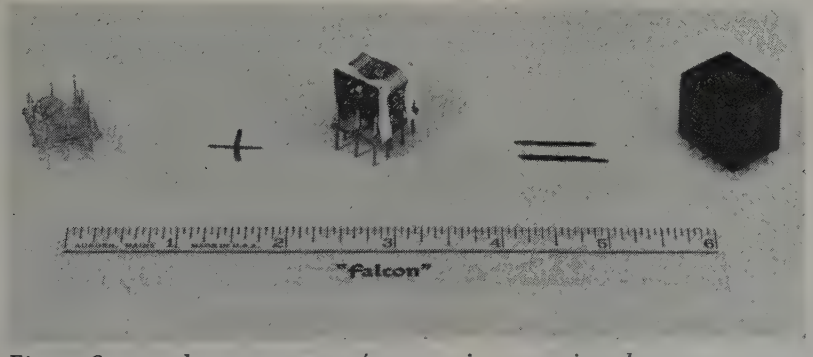

Figure 2, a moderate amount of success in protecting the memory cores from processing damage was attained by coating the memory cores with room temperature vulcanizing silicone after winding. Left to right, silicone coated cores are connector-header, complete, unencapsulated assembly, and the encapsulated shift register.

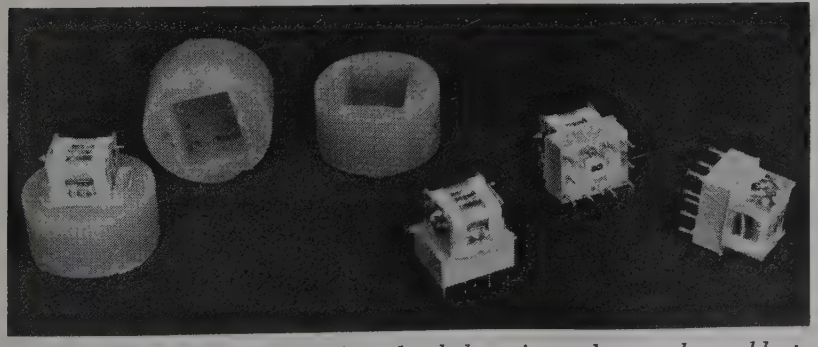

Figure 3, paper coating grade polyethylene is used to make molds to contain the room temperature curing silicone rubber or the epoxy-polysulfide material. These molds can be used and reused without any type of release agent.

Introduction

Lead time, the chronological chasm between the drawing board and the shipping dock, is generally the most critical phase of any given high priority project. Short lead times have become a necessary corollary to the successful manufacture of advanced electronic systems.

The packages or envelopes surrounding the components that comprise a system are among the chief concerns of the design engineer and the packaging engineer. In most instances the space allotted for the developing electronic system is determined by the weight and geometry of the vehicle, and the ingenuity and skill of the design and packaging engineers must overcome the handicaps of limited size without sacrificing any functions or systemic reliability.

Lead time was cut drastically in the repackaging and miniaturization of an existing airborne computer by Hughes Aircraft Co. Close, thoroughly integrated cooperation throughout the whole company held lead time to an absolute minimum and brought the project through to maturity.

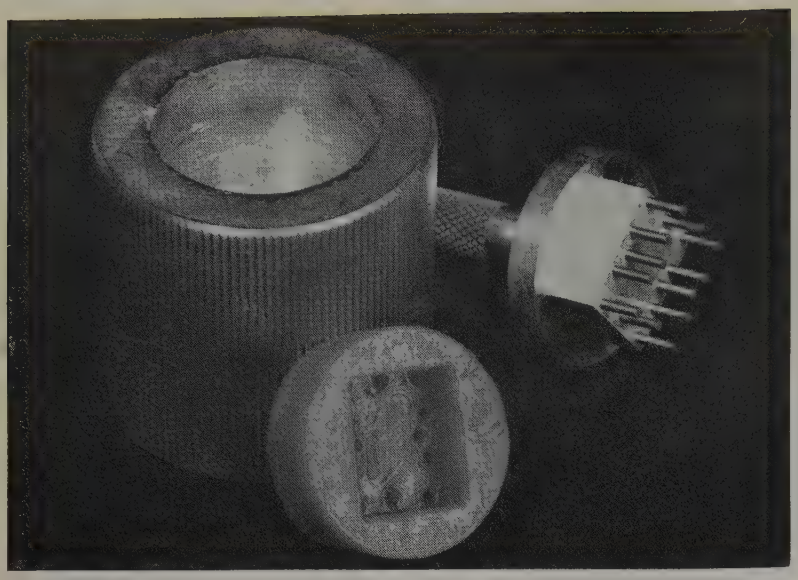

Figure 4, this photograph shows the essential features of the master mold for forming paper-coating grade polyethylene into molds. Left to right, housing for mandrel; completed polyethylene mold; mandrel.

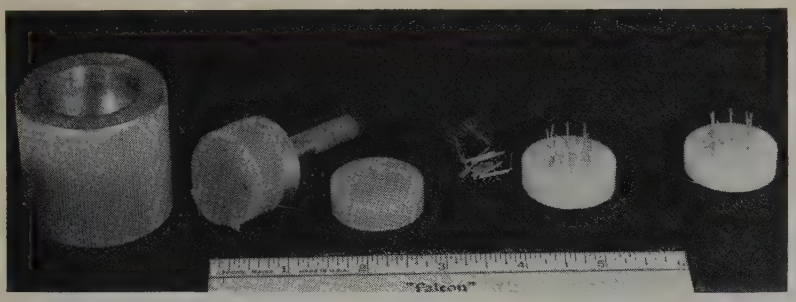

Figure 5, this tooling was used to produce the preproduction quantities of the precision terminal board for the shift register. Left to right, mandrel housing; mandrel with chilled polyethylene mold still attached; polythylene mold; terminal pins; terminal pins placed in mold; mold poured with epoxy resin. (See figure 1. The structure on the extreme left of figure 1 is one of these preproduction terminal boards wired to the memory cores.)

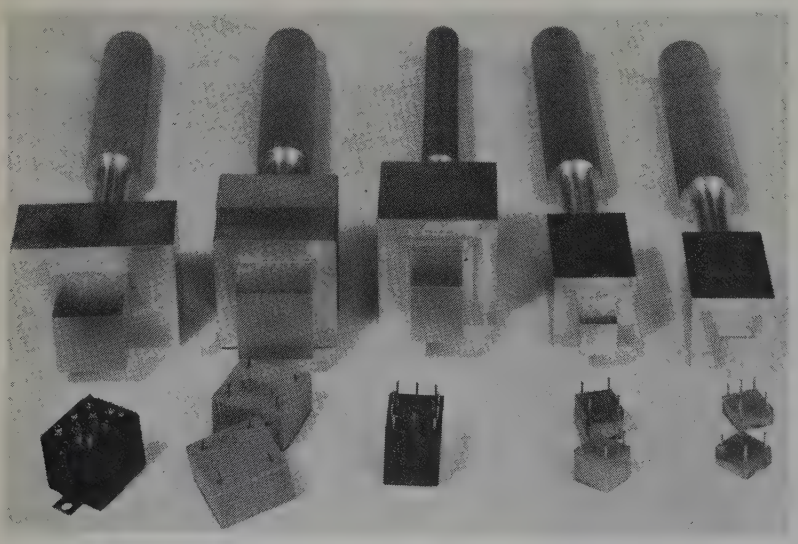

Figure 6, this photograph illustrates typical master dipping mandrels, and the encapsulated units made from the slush molds. Left to right: Power supply transformer; rectifying networks; two-bit shift register; ferrite cup core transistor transformers; and right, toroidal core transistor transformers.

One important part in the development of this project was the miniaturization of the computer's memory. A core type memory was used in a delay-line type shift register. The cooperation and close coordination between the design engineers, packaging engineers, and materials and processes engineers involved in the packaging of this memory module was typical of the organization-wide cooperation that characterized the project.

The development of the packaging procedure along with the short lead time innovations are discussed from the point of view of the materials and processes engineers.

Problem

A miniature computer memory device had to be packaged in a volume of less than thirty-five hundredths of a cubic inch. The module was a "two bit" shift register of the delay line type. The package contained two memory cores, two resistors, two diodes, two capacitors, and two inductors, all the interconnecting circuitry, and a precision header to connect to an etched circuit board. A number of considerations had to be weighed in the light of a very short lead time and a very small developmental budget. The most pressing considerations were:

1. The memory cores were extremely sensitive to shock, pressure, and foreign materials, and the processing of the cores and their intended environment could not interfere with the memory cores' proper electronic functioning.

2. Tool costs had to be held to an absolute minimum.

3. The internal structure of the module had to be adaptable to printed circuit connecting techniques, even though the original budget and the number of developmental computers did not warrant this type of structure.

4. The processes used to produce the developmental modules had to be capable of producing large numbers of production modules without significant changes in the sequence of processing operations.

5. The processes had to assure the reliability of the module.

6. The developmental units had to be identical in size, function, and environmental resistance to the units that would be produced in quantity when the project matured.

Approaches Used to Solve the Problem

Modules

The modules were based on strain-sensitive toroidal cores. These cores consisted of a lamination, .000125-inch thick magnetic material, wound on a stainless steel bobbin. The overall dimensions of the bobbin were: .175-inch outside diameter, .145-inch inside diameter, and .045-inch height.

The lamination on these bobbins was so sensitive to mechanical stress that touching the lamination gently with a camel's-hair brush would cause detectable drops in inductance. The sharp outer edges of the bobbin case also presented a problem, since they could very easily cut through the insulation and the wire of the coil.

Therefore, the packaging procedure had to take into account the above considerations and the fact that the processing could not appreciably increase the value of the coil's distributed capacity, lest the unit would not perform electronically.

The evolution of the processes was based on previous work which showed that quality of the finished product was more dependent on the methods of applying the materials than on the materials alone.

The first attempts to wind on the toroidal core as received from the vendor ended in failure, since the sharp outer edges of the steel bobbin cut into the fine wire. Wrapping the outer side of the bobbin with polyester film tape not only proved clumsy but also caused a large number of electronic failures, since the taping disturbed the lamination. The most practical manner for solving the problem was to make a plastic sleeve on a screw machine to fit over the core and then impregnate the core with 100 centistoke silicone fluid. See figure 1.

In spite of the silicone fluid impregnation, the cores still deteriorated when they were wound and encapsulated. Investigation showed that the deterioration was caused by the en-

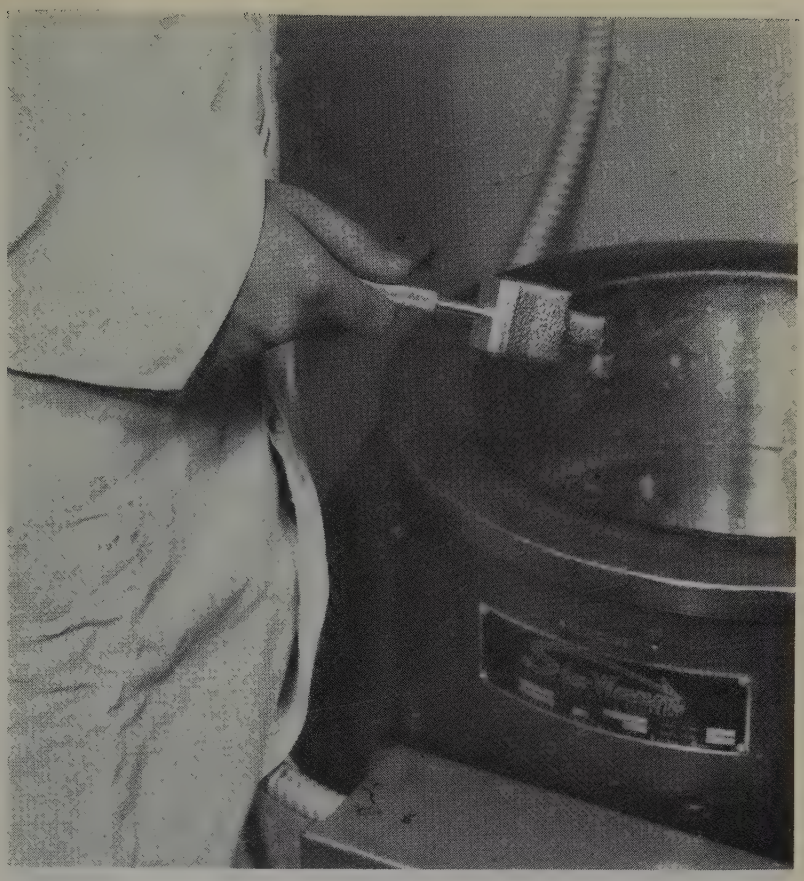

Figure 7, a mandrel, similar in design to those illustrated in figure 6, is dipped into the tin-bismuth eutectic alloy. The molton metal crystallizes around the mandrel. The mandrel is then withdrawn from the melt, and the crystallized metal is removed from the mandrel by sliding it off the master form. A master can generally be dipped two or three times before it becomes necessary to cool the material so that it will continue to act as a heat sink.

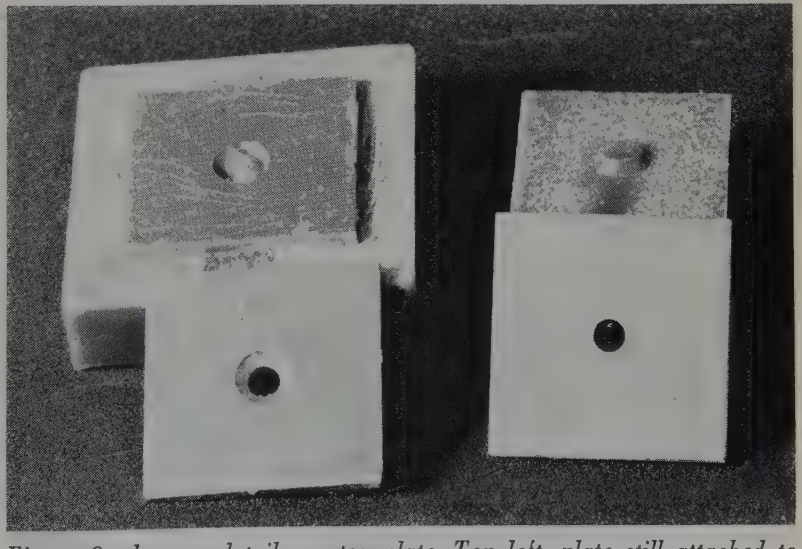

Figure 8, close-up details on top plate. Top left, plate still attached to cured resin from reservoir block. Note how the resin shears off in the hole. Bottom left, the same view of the plate, removed from the resin block. Top right, unit removed from mold and plate. Notice the cone-like sprue left on the unit. Bottom right, same view of plate removed from unit.

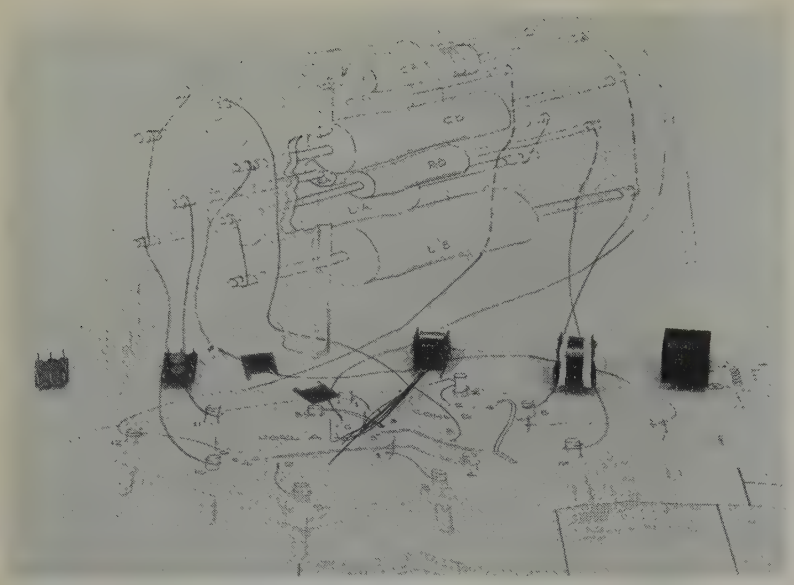

Figure 9, this photograph illustrates the final method used for assembly of the two-bit shift register. Left to right: Transfer molded melamine terminal base; memory cores wired to terminal base; printed circuit side boards for other components; assembled component network; completely assembled register; and, extreme right, encapsulated register. Backdrop is isometric of original, experimental assembly.

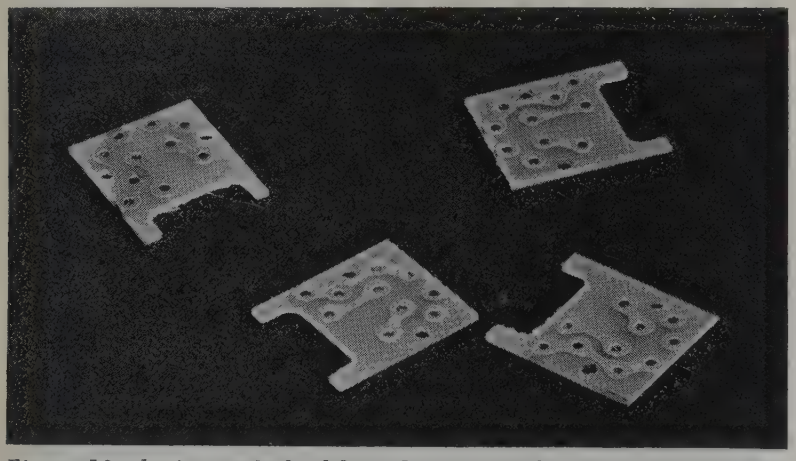

Figure 10, the isometric backdrop drawing in figure 9 shows how the original shift registers were packaged. The actual package is shown in the center of figure 2. The etched fiberboard laminates illustrated here replaced the jumper wires and the impregnated paper sideboards used on the preproduction developmental modules.

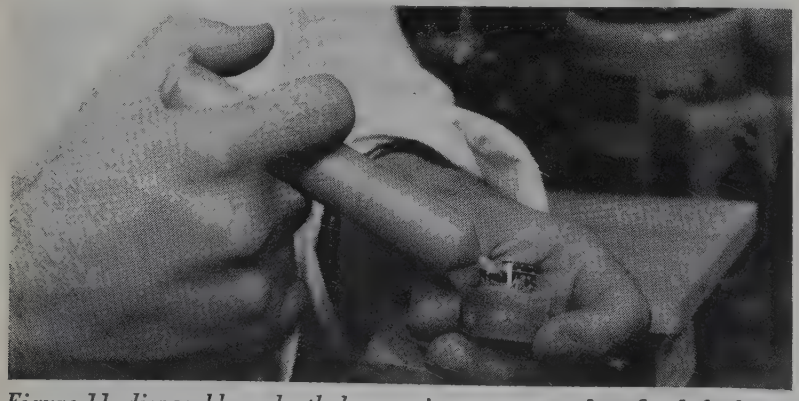

Figure 11, disposable, polyethylene syringes were used to flood the lower portion of the module with silicone rubber or a thixotropic epoxy polysulfide resin.

capsulating resin penetrating the windings and the laminations.† Encasing the individual memory coils in a room temperature vulcanizing silicone rubber protected the coil and core against the resin when the encapsulation was conducted without a vacuum cycle. See figure 2.

Experimental investigation showed that the individual rubber encapsulated memory coils leaked air when the pressure was dropped below 380 mm Hg abs. This meant that resin could penetrate the rubber shell during encapsulation, or that the air leaks could cause a partial vacuum under the rubber, resulting in a deforming hydrostatic pressure on the memory coils. In either case the memory coils were ruined electronically.

Encapsulation of the module without vacuum, or with a vacuum of 250 mm Hg abs., yielded units that were good electronically but were full of voids and bubbles necessitating a large amount of rework. Since, in all cases, the resin was poured into the mold at atmospheric pressure, there was no precise control of the height of the unit, making the final dressing of the encapsulated module difficult.

Flooding the toroidal coils with silicone rubber was next tried. A number of toroidal transistor transformers were made in this manner and encapsulated under high vacuum of less than .2 mm Hg abs. The same process was tried with the shift register package. The assembly was placed in a polyethylene mold and then flooded with the silicone rubber. This procedure protected the memory cases against the vacuum. See figure 3.

Production experience eventually showed that a thixotropic epoxy-polysulfide formulation was as effective as the room temperature vulcanizing rubber and was easier and cheaper to use. As a result, the silicone rubber was phased out in favor of the epoxy-polysulfide material.

Originally, the vacuum encapsulation process seemed to be causing a large number of open circuits in the shift register module. A thorough investigation proved that unreliable solder joints were to blame rather than vacuum encapsulation proce-

dures.*

One problem which caused concern during the early phases of production and which was totally unexpected on the basis of the developmental work was a large number of defective modules found during the pre-encapsulation electrical tests. Most of these modules were electrically defective because of a poor signal-to-noise ratio or low output from the memory cores. These symptoms were identical to those caused by encapsulation resin flooded memory cores. An exhaustive investigation showed that solder flux was getting on the laminations wound on the toroidal core. The production memory cores were procured with a plastic shield to protect the ultrathin laminations within the steel bobbin. Gaps between the plastic shield (see figure 1) and the steel bobbin allowed the molten flux to seep into the bobbin case where it cooled and hardened on the laminations. Vapor-solvent degreasing with ethyl alcohol removed the contaminants from the laminations without damage to any of the other components and restored most of the modules to acceptable performance levels.

Tighter quality control and supervision on the assembly lines, coordinated with the use of cored solder of minimum flux content, eliminated this problem.

The memory coils were originally wound with No. 42 AWG single polyvinyl formal wire. Stripping the wire for soldering to the leads and other components with a chemical stripper was a slow and damaging process. It was impossible to remove the chemical stripper completely, and the danger of eventual corrosive failure was great; therefore, coils were thenceforth wound with the solderable enamel wire.

Tools

The tooling methods used in this project were compatible with the low budget allowed for tools.

Polyethylene Tools

The precision that is required for the location of terminals for printed circuit applications is well known. The lead time on machine molded parts was substantial, and there was no way of knowing whether the design of the module was workable. The use of polyethylene tools eliminated the lead time and averted the possibility of scrapping an expensive compression mold.

There are a number of so-called "paper coating grades" of polyethylene on the market. These materials melt in the range of from 95°C to 115°C, and have viscosities that

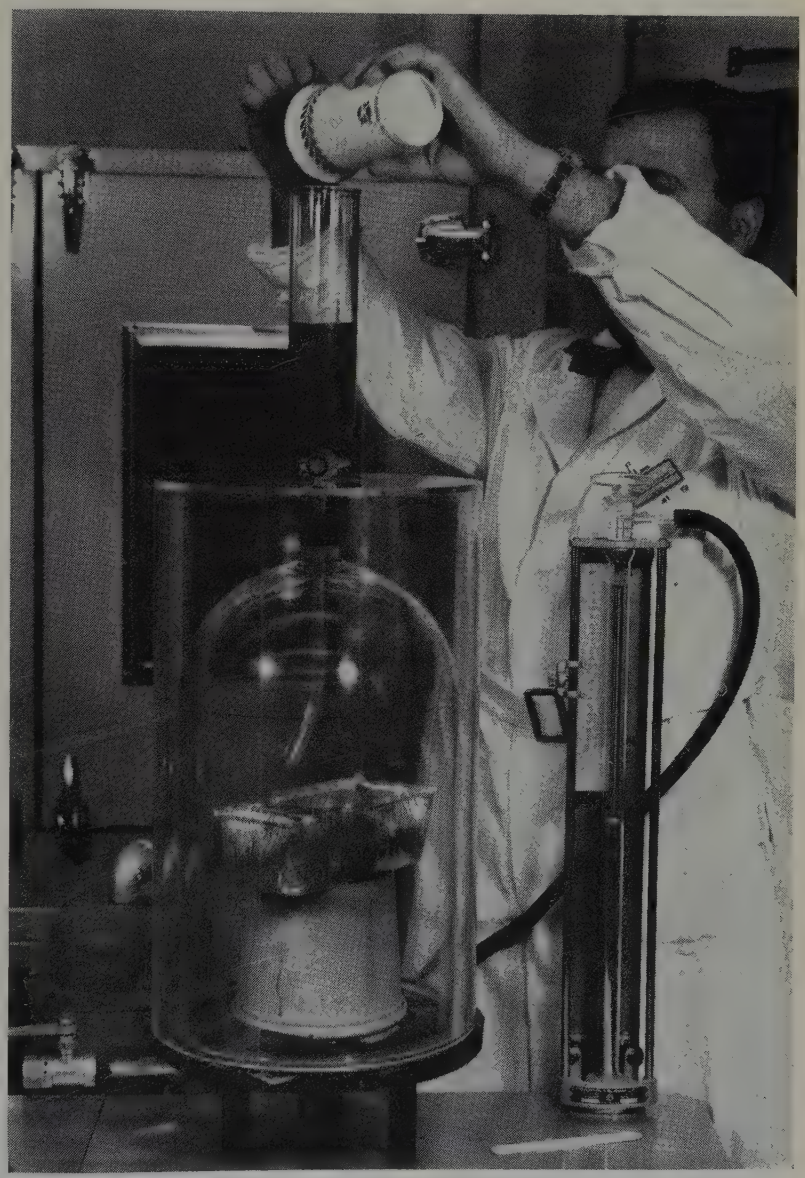

Figure 12, laboratory encapsulation stand. This apparatus consists of a bell jar set on a gasketed vacuum plate. A dropping funnel is set into the top of the bell jar for the purpose of admitting the resin into the chamber under vacuum. An acrylic plastic shield is placed around the bell jar to protect against any implosion which might occur. The valve on the left is to control the degree of a vacuum and to act as a release valve. The stand at the right contains a Dubrovin gauge which will indicate pressures from less than .2 mm Hg. abs. to 20 mm Hg. abs. The vacuum pump and the protective air filter are not shown.

† *(Unpublished data, Hughes Aircraft Company)* The Temperature Coefficient of Inductance in Encapsulated Small Audio Transformers, *R. B. Feuchtbaum, D. Gurevics, J. Hutter; First National Conference on the Application of Electrical Insulation, Cleveland, Ohio, Septemper 1958.*

* *"The Folklore of Encapsulation, Feuchtbaum, Engquist, and Keister;* Insulation, *May 1961.*

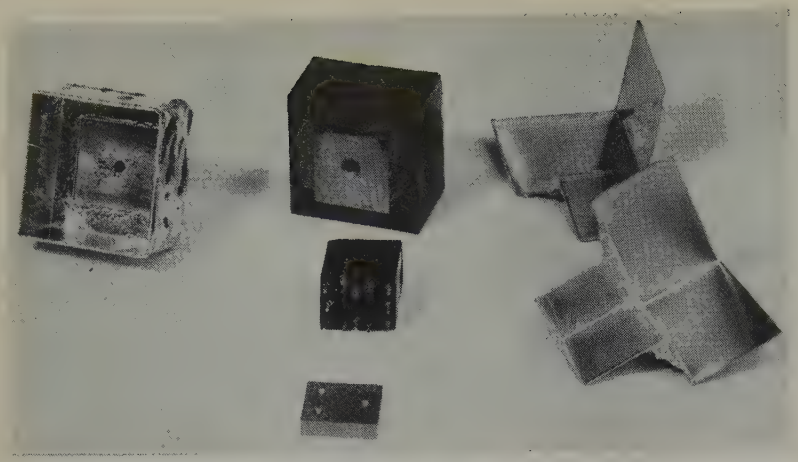

Figure 13, left to right: assembled mold; disassembled cured unit; and removed eutectic mold. Notice the absence of flash on the encapsulated component.

range from 5,000 to 20,000 cps.

Master molds were made from aluminum to the required dimensions, and molten polyethylene was poured into these molds. When the polyethylene cooled, the polyethylene was trimmed to height and stripped from the mandrel. The polyethylene molds are permanent in regard to the use of room temperature vulcanizing silicone, and epoxy resins that cure below 90°C. These molds can be used over and over and do not require any release agent. See figures 4 and 5.

Encapsulation Molds

The molds used for encapsulation are based on slush molds made from simple aluminum mandrels. See figure 12. These mandrels act as a heat sink when they are dipped into the eutectic alloy. The tin-bismuth eutectic alloy melts at 142°C, and when the cool aluminum master is dipped into the molten metal, some of the metal crystallizes around the master mandrel. This method has yielded up to 200 molds per hour per mandrel (see figures 6 and 7).

On the average, the master mandrel may be used to form three or four slush molds before it starts to lose its ability to act as a heat sink. Water is generally suitable as a coolant bath; however, when a large number of molds are required in a short time, it is advisable to use an ice-water bath, or a dry ice acetone bath as the coolant. For extremely high production rates, a cooling manifold with a circulating coolant can be incorporated into the master mandrel.

Mold Accessories

The mold accessories, in the case of the units discussed in this paper, are the top plate and the terminal block. The slush mold controls the cross section of the module, and the top plate and terminal block control the height of the unit. The top plate performs an additional function, since it contains the sprue hole through which resins are introduced into the mold cavity. If the design of the unit can be integrated with the design of the mold, it is possible, in some cases, to eliminate the terminal block, and thus simplify the mold even further. In any case, slush molding coupled with high vacuum encapsulation gives a cheap, high yield method for producing extremely rugged modules.

The design of the top plate is simple and extremely important. The hole in the plate admits the resin. The proper design of the sprue hole also insures a clean break and easy cleaning when the mold is disassembled (see figure 8). The sprue can easily be removed from the finished unit by sanding.

Internal Structure of the Module

The assembly of the shift register was simple. In these instances the unit to be encapsulated was just wired to the terminal base and then encapsulated. The shift register required that 10 components, 12 precisely located terminal pins, and some 50 solder connections be contained in a volume of less than .35 cubic inch. The original package is shown in figure 3. The detailed isometric drawing of the original package is the backdrop in figure 9.

The original terminal boards were cast in polyethylene molds with a flexible epoxy resin that cured at temperatures below 85°C. The side boards to hold the inductors, resistors, diodes, and capacitors were stamped from .032-inch fiber board. The connections between the components in the cordwood package and the memory coils were made with jumper wires. The jumper wires were insulated with a heavy, solderable enamel.

The assembly of the package was refined by the use of machine molded melamine terminal boards and printed circuit side boards for the cordwood component assembly. The adoption of the printed circuit side boards, after the basic design proved practical, saved about two-thirds of the assembly time required for the fiber board construction. See figures 9 and 10.

Except for the changes in the wiring methods and in the substitution of compression molded terminal for the cast epoxy terminal boards, the configuration of the early developmental models of the shift register, and the final production configuration remained the same. This process was reflected throughout the whole computer, and only a minimum redesign of the etched boards and interconnection hardware was needed. This helped save both the company and the customer time and money.

Production Processes

The shift register module was first placed in a low molecular weight polyethylene mold. The base area of the unit, where the memory cores are located, was flooded with a room temperature vulcanizing silicone. In later production runs, this material was changed to an epoxy-polysulfide resin, although the application procedures remained identical (see figure 11).

After the protective resin had cured, the modules were tested and loaded into the eutectic alloy molds and vacuum encapsulated with an aromatic amine cross-linked epoxy resin. The production equipment is essentially a scaled up version of the laboratory pilot plant illustrated in

figure 12.

After the modules are cured, it is a simple matter to disassemble the unit by cracking away the eutectic mold (see figure 13).

The methods of encapsulation described in this report are extremely versatile, cheap, and are easily adapted to large-scale production. The equipment illustrated in the report is, of course, laboratory apparatus and is not adapted to large-scale production. Production equipment, scaled up from the laboratory model, can easily handle more than 100 components an hour.

The disassembly operations are also greatly simplified. No great amount of care is needed to take the molds apart, and the pieces of the old molds are returned to the melting pot to be reused.

If the cost of the aluminum mandrel and the simple accessories is weighed against the cost of several score machined cavities, along with the involved assembly and disassembly procedures, this process becomes very attractive.

If the current practice of potting units in preformed plastic shells is examined, again the slush molding is cheaper. If special shapes are required, slush molding is immediately cheaper on the tooling charges alone. Where standard shells are considered, up to 200 slush molds per hour per worker is a very convincing argument in favor of slush molding.

Reliability Assurance

The close cooperation between the engineers that allowed complete and minute investigation of every fault and failure in both the finished and partially finished modules enabled the process engineers to devise procedures that maintained the physical and electrical integrity of the memory core module.

Sameness of the Units

The whole article shows how the physical and electrical parameters of the module were kept constant throughout the development period until the designs were frozen for production. The savings in lead time are obvious.

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Development of a High Temperature Epoxy Casting Compound

By Harold I. Reynolds, Materials Engineer, Minneapolis-Honeywell Regulator Co., Minneapolis.

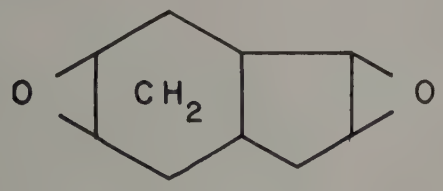
Abstract

A new, long pot life, epoxy casting compound has been developed for high temperature use (400°F continuous) in potting and encapsulating electrical and electronic components and devices. The resin formulation was developed to replace a lower temperature (300°F) epoxy casting compound which had been used previously in several critical applications.

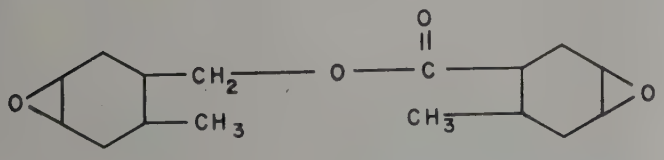
It is based upon a diepoxide derived from peracetic acid. Results are reported for an anhydride cured system which uses an inert, inorganic filler. The casting compound features a low, stable, coefficient of thermal expansion (CTE) over a wide temperature range. It also possesses a room temperature pot life of several days, which is a decided advantage for small production lots, and good dimensional stability at elevated temperatures.

Introduction

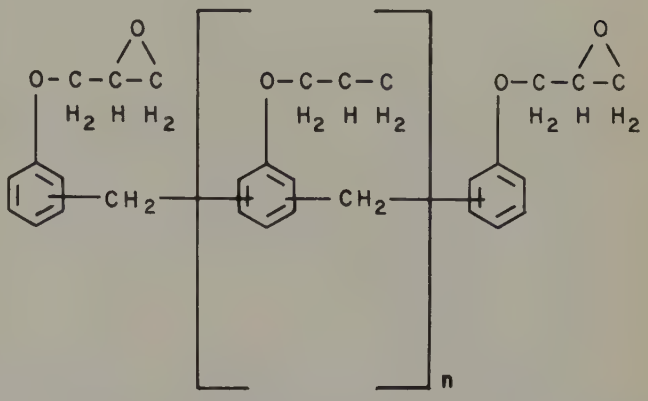
The resin formulation, developed by the Aeronautical Division of Minneapolis-Honeywell Regulator Co., is based upon a liquid diepoxide which was derived from peracetic acid by Union Carbide Chemicals Co. Preliminary investigations evaluated a solid diepoxide (shown by the formula below).



However, this material proved to be unsatisfactory because of its tendency to sublime and emit white, acrid fumes at the elevated temperatures necessary to dissolve it into the liquid hardener-based casting resin. The solid diepoxide was discarded after considerable effort to find suitable techniques in handling in favor of the low viscosity, liquid diepoxide (shown by the formula below):

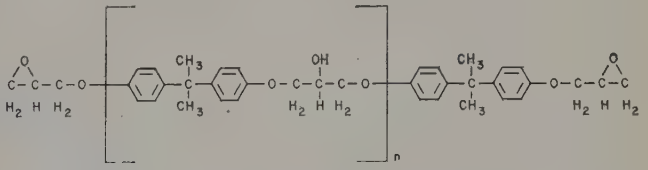


Also evaluated was an epoxy Novolac resin (shown by the formula which is at the top of the following column.



This also gave difficulty in handling and showed no decided dimensional stability advantage over the liquid diepoxide. Because we wanted to develop a material of low coefficient of thermal expansion (CTE) to solve critical design problems, considerable attention was given to the selection of a filler. Commonly used fillers such as silica, titanium dioxide, and calcium carbonate were rejected in favor of an inert, inorganic filler of zero CTE. This new filler also has a slightly lower density than the other common fillers.

Several hardeners were evaluated. One of the hardeners tried was pyromellitic dianhydride (PMDA), which has produced cured epoxy resins easily capable of 500°F sustained service. PMDA being a solid is difficult to dissolve in both conventional, bis-phenol A-epichlorohydrin type, epoxies (shown by the formula below):



and the diepoxides; its curing action most likely proceeding from a very finely divided solid suspension. Other hardeners tried were hexahydrophthalic, maleic, and phthalic anhydrides. Methyl nadic anhydride (MNA), a fluid hardener, was chosen for full evaluation. Its low viscosity made it attractive as a hardener for a low viscosity, easily handled system with promising high temperature properties. Several amine accelerators and polyol initiators were screened as agents to accelerate cure rates in the slow curing anhydride systems. Formulations were given an initial screening by use of a 24 hour 482°F soak in a forced air oven. Those systems which maintained a relatively low weight loss were evaluated further.

Development Program

Solid Diepoxide System

The solid diepoxide was not as soluble in MNA hardener at room temperature as was desired. When the resin was dispersed into the hardener at room temperature and then heated, the solubility increased as the temperature was increased up to 250°F. However, at this temperature the mixture gave off copious amounts of white, acrid smoke. Most of this smoke evolves from the solid diepoxide alone with heat, although MNA, when heated alone will smoke slightly at 250°F. The stoichiometric ratio of diepoxide to MNA was dissolved at 250°F, a polyol initiator was stirred in and filler was added when desired. If the temperature dropped too much during these operations, there was danger of the resin recrystallizing out of the solution. No suitable cures were obtained with this system even with the addition of alpha methyl benzyldimethylamine or stannic chloride catalysts. PMDA was extremely reactive with solid diepoxide/MNA/polyol combinations at high temperatures.

Solid/Liquid Diepoxide System

It was found that the solid diepoxide is quite soluble in the liquid diepoxide at room temperature. When the MNA was used here as a "solvent" for the diepoxide, and at the 250-300°F temperatures necessary to dissolve the resin, the addition of small amounts of PMDA hardener caused gelation almost on contact. Some of the best results with this system were obtained with a 1:1 solid to liquid resin combination using trimethylolpropane and MNA with a trace of PMDA. In general, these cures were medium (1 hour) to fast (15 minutes). However, whenever PMDA was used, the 24 hour 482°F weight loss ranged from 1.1% to 5.4%. MNA hardened epoxy Novolac and liquid diepoxide showed lower accelerated weight losses of 0.28 and 0.36%, respectively. The solid/liquid diepoxide mixture with polyol/MNA/PMDA gave a low accelerated weight loss of 1.1%; and a room temperature pre-mix (minus PMDA) was usable up to a week. However, the weight loss samples were flexible at 400°F, so testing of this combination was stopped.

Liquid Diepoxide System

In contrast to the solid diepoxide, the liquid diepoxide was easily cured with many hardeners. In order to provide the high standards of quality demanded for our devices, it was important that we develop a compound of an exceedingly high dimensional stability at elevated temperatures. Polyols perform much the same as accelerators in hastening the cure and in addition contribute room temperature toughness. Considerable brittleness was experienced throughout the early stages of development when no polyol was used and, unfortunately, with flexibility at elevated temperatures when polyol was used. Some work was done using 1, 2, 6-hexanetriol, but these formulations also exhibited flexibility at elevated temperatures. In general, the polyols gave good room temperature toughness but their use was discontinued because of poor dimensional stability of the cured resin.

Results

Table 1 next page summarizes many of the formulations based on a liquid diepoxide/MNA hardened system. Fillers were added to some to study their effects. All filled resins were required to be easily pourable at 170°F. As can be seen in the table, we did not run heat distortion temperatures on all samples because factors such as brittleness or flexibility precluded such a test.

Formulae numbered 1 through 18 (not shown in the table) were based on the solid diepoxide. Formulae 19 through 45 were based on the liquid diepoxide. The missing numbers in the sequence were on formulations for which insufficient data were collected, or on those for which there was not enough material available with which to cast a suitable sample for testing. The optimum formulation was based on a material exhibiting the combination of the lowest weight loss in 24 hours at 482°F with the highest HDT, formulae 24 and 25.

Evaluation of Formula 25

Physical and Electrical Properties

With the excellent combination of low weight loss and high HDT obtained by formulae 24 and 25, formula 25 was chosen for further evaluation. Wherever possible, ASTM testing procedures were followed.

Heat Distortion Temperature (HDT)

This value (see table 1) was determined per ASTM D648 at 264 psi pressure on the test piece. The addition of filler had no significant effect on the HDT.

Coefficient of Thermal Expansion (CTE)

The CTE for this material is lower than that of any known commercially available epoxy system. The curve (see figure 1) is characterized by a broad relatively flat region between 80°C and 180°C, where CTE rises very slowly with increasing temperature. It parallels the curves for aluminum and steel in this temperature range where their CTE increase is also very gradual with temperature. By using this new material as a casting compound around or within metal shapes, less stress will be produced in the epoxy than with conventional epoxies whose CTE curves rise rather sharply, especially above 100°C (see figure 1).

Differential expansion in this formulation is nearly zero between 80°C and 180°C. It is this unique property in this new compound that we are studying for further appli-

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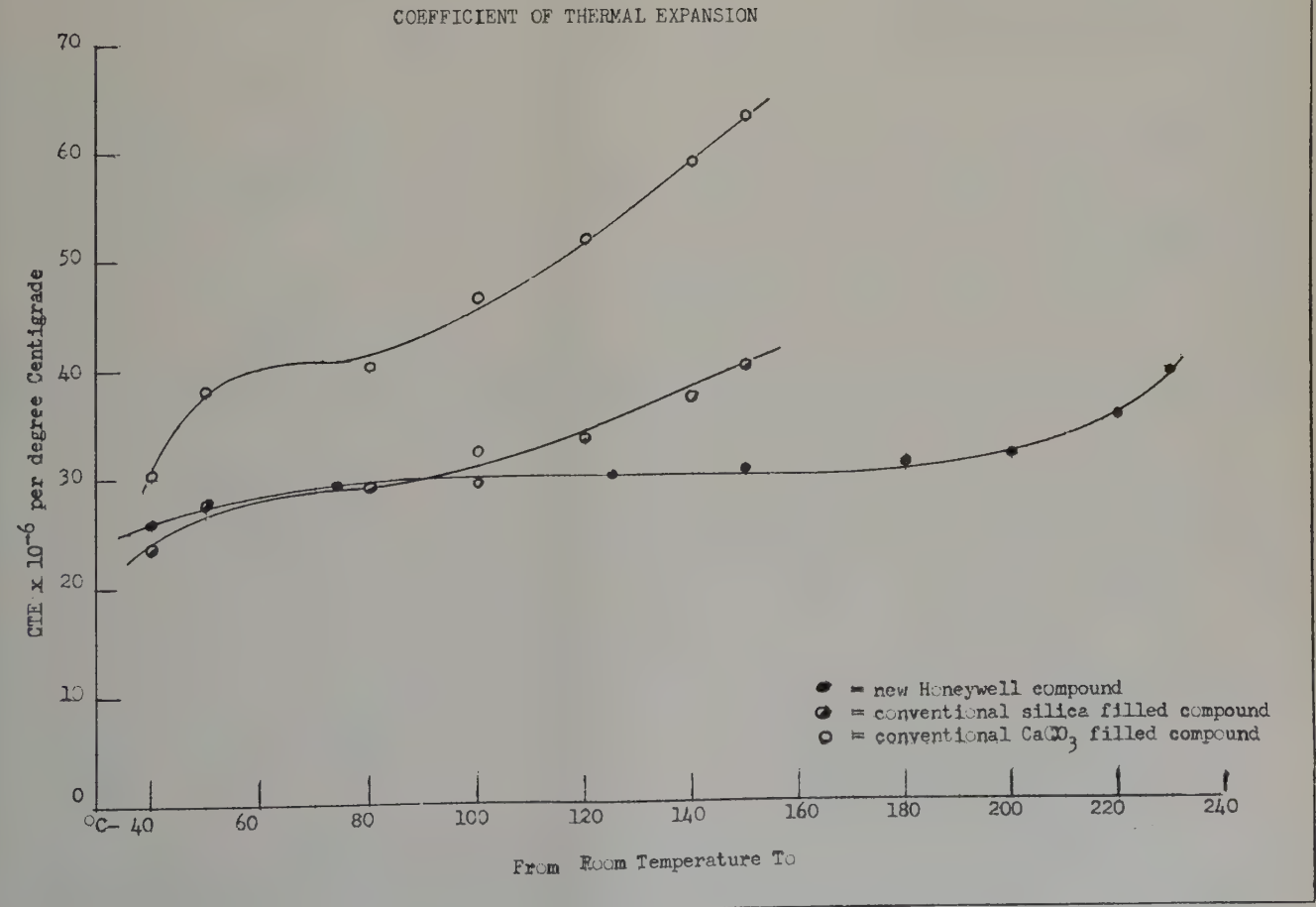
Explanation of Table 1 Notes:

1. *Weight loss after 24 hours at 482°F determined on a cast sample 1" x 2" x ⅛".*
2. *2,4,6-Tri (dimethylaminomethyl) phenol.*
3. *Zirconium silicate.*
4. *Lithium aluminum silicate.*
5. *Calcium carbonate.*
6. *Tetrahydrofurfuryl alcohol plus 1% dicyandiamine.*
7. *Hexahydrophthalic anhydride.*
8. *Dimethylbenzylamine.*
9. *Hours/temperature: plus hrs/temp.: etc.*
10. *All filled systems based on 60% by weight of filler.*

Table 1—Summary of Trial Formulations

Formula Number	Catalyst	Filled[10]	Wt. Loss[1]	HDT	Cure[9]
19	ethylene glycol	no	1.37	flexible	16/250:4/350:4/400
22	TA[2]	yes[3]	0.71	—	4/250:4/350:4/400
23	TA	yes[4]	0.53	335	16/250:8/325:16/400
24	TA	yes	0.36	428	16/250:8/325:16/400
25	TA	yes	0.39	444	16/250:8/325:16/400
26	TA	no	0.66	—	16/250:8/325:16/400
27	PMDA	yes[3]	2.18	—	16/250:4/350:4/400
28	PMDA	yes[5]	—	brittle	—
30	PMDA + ethylene glycol	no	—	spongy	—
31	PMDA	yes[4]	1.94	—	—
33	THFA-DCDA[6]	no	—	flexible at 400	16/250:4/350:4/400
36	HHPA[7]	no	2.60	brittle	16/250:6/400
37	HHPA + glycerine	no	5.0	flexible	—
38	1,2,6 hexanetriol	yes[4]	1.72	flexible	4/250:4/350:4/400
39	trimethylolpropane	yes	2.01	—	4/250:4/350:4/400
40	DMBA[8]	no	0.77	—	none after 16/250
41	stannic chloride	yes[3]	—	—	gel too fast
43	phthalic anhyd. only	yes[4]	2.68	286	—
44	HHPA only	no	2.60	brittle	16/250:6/400
45	HHPA + ethylene glycol	no	5.0	flexible	16/250:64/400

FIGURE 1



cations. This low, non-changing CTE means in practice that we can design metal to plastic bonds with less chance of stresses being set up between the plastic and metal over a rather wide temperature range.

Flexural Strength

Flexural strength (per ASTM D790) was determined at several temperatures from room temperature to 450°F, and up to 500 hours aging at the test temperature. The results are listed in table 2. As would be expected from HDT studies, the flexural strength drops off rather sharply at 450°F. This was one of the factors which helped to decide the upper design-temperature limit.

Table 2—Flexural Strength

Condition	Flexural Strength, psi
As cast, RT	12,900
At 325° F, 1 hr age	9,000
At 325° F, 168 hr age	9,600
At 325° F, 500 hr age	9,100
At 400, 1 hr age	7,300
At 400, 168 hr age	6,900
At 400, 500 hr age	4,900
At 450, 1 hr age	4,000
At 450, 168 hr age	—
At 450, 500 hr age	500

Izod Impact Strength

Notched Izod impact strength was run on a ½″ x ½″ x 2½″ specimen with the standard 0.010″ radius notch. The average of 6 samples was 0.35 ft-lbs/in of notch. This compares favorably with standard filled epoxy potting compounds.

Water Absorption

Water absorption was run on a 1″ x 2″ x ⅛″ sample after 24 hrs immersion in distilled water at room temperature and at 200°F. The results are shown in table 3.

Table 3—Water Absorption

Condition	Wt. Increase, %
Room temperature	0.26
200 °F	0.85

Weight Loss, Long Time Aging

Weight change is a good method for determining degradation due to a high thermal environment. Weight change, represented as percent loss, was determined on standard 1 x 2 x ⅛ inch samples after heat aging at 325, 400, 450, and 500°F at intervals up to 2000 hours. Results are tabulated in table 4.

The physical appearance of the samples was good at the 325°F temperature with only a very slight darkening. At 400°F all samples had darkened, but no disqualifying degradation was evident. At 500°F the test was stopped after 350 hours because the samples were badly blistered, warped, and could be easily broken between the fingers.

Dimensional Stability

This is a primary factor in the selection of any plastic compound when it is designed for use at elevated temperatures. Changes in length, thickness, and width were determined on 1″ x 2″ x ⅛″ samples after heat aging at 325, 400, 450, and 500°F at intervals up to 2000 hours. Table 5 records the total percentage change in each direction after 2000 hours aging at the temperature indicated. The test was stopped after 100 hours at 500°F because the samples were badly warped and blistered.

Adhesive Strength

Adhesive strength was determined at room temperature, 325°F, 400°F, and 450°F on steel to steel tensile-shear strips. The specimens were sandblasted and solvent cleaned thoroughly with acetone. Overlap was 0.5-inch on standard cold rolled steel and the Tinius-Olsen crosshead motion was 0.05 inches per minute. The results in table 6

Table 4—Weight Loss

	% Weight Loss After (Hours)				
Age Temperature, °F	25	50	100	1000	2000
325	0.35	0.35	0.39	0.41	0.59
400	0.41	0.46	0.55	1.91	4.02
450	—	—	1.11	5.50	8.26
500	1.69	2.68	4.10	12.01(1)	—

(1) Test stopped after 350 hrs.

Table 5—Dimensional Stability

	% Change		
Age Temperature, °F	Length	Width	Thickness
325	0.16	0.19	0.44
400	1.07	1.18	2.42
450	4.15	3.62	3.34
500	1.67(1)	1.65(1)	—

(1) Test stopped after 100 hours.

are the average of 5 tensile shear specimens under each temperature condition.

Table 6—Adhesive Bond Strength	
Temperature	Average Strength, psi
At room temperature	3,000
At 325 after 1 hr at 325	2,700
At 400 after 1 hr at 400	2,600
At 450 after 1 hr at 450	2,400

Insulation Resistance

Insulation resistance was run on 3″ x 3″ x ⅛″ samples in accordance with ASTM D257-54T at 400, 450, and 500°F after aging at those temperatures for 1000 hours. Table 7 lists the results.

Table 7—Insulation Resistance	
Temperature	IR, Ohms
At room temperature	1.0×10^{12} (1)
At 400°F after 1000 hrs at 400°F	4.6×10^{9}
At 450°F after 1000 hrs at 450°F	6.0×10^{11}
At 500°F after 1000 hrs at 500°F	5.0×10^{8}

(1) Limit of megohm bridge used for testing; in all tests an emf of 500 volts d-c was applied for 1 minute.

Conclusions

Following the experimental work in our Materials Engineering Laboratory, we decided to try this new casting compound in a production device which had previously used a calcium carbonate filler. The carbonate filled epoxy expanded to such an extent that the device ceased to function after a short period of time at the operating temperature of 350° to 400°F. Since this new material has been used, there has been no record of failures. This is chiefly due to its much lower coefficient of thermal expansion and its good dimensional stability at the operating temperature.

An advantage of this material over a carbonate or silica filled epoxy is its handling characteristics. It is quite pourable at room temperature and has a pot life of approximately five days at room temperature and 10 hours at 170°F. In our production applications, where small lots are common, it is advantageous to be able to have a substantial quantity of a potting compound available for a complete day's run.

Its long gel time is another advantage for our use since it will enable potted components to reach gel temperature before the material sets to a rigid compound. We believe this will result in less internal stress in potted units, thereby increasing their reliability. The present cure time is quite long; a total of 40 hours. However, this can be compensated for by adjusting the production schedule to accommodate the cure.

Acknowledgment

Acknowledgment is made to W. E. Gates for his contributions to this paper.

People in the News

The Joclin Manufacturing Co., Wallingford, Conn., has advanced *Richard M. Clarke* to general manager and *Stephen C. Markham* to sales manager.

Directors of Oak Manufacturing Co., Crystal Lake, Ill., have elected *Edward D. Chalmers*, vice president, engineering, and *Edward J. Mastney*, vice president, advanced engineering and manufacturing, a newly created position.

Richard M. Jansson has joined the Frederick S. Bacon Laboratories, Watertown, Mass., as a project engineer and will work on electronic encapsulation techniques and other problems.

The Brush Beryllium Co., Cleveland, Ohio, has appointed *Lloyd E. Herr* as a ceramic sales engineer in its Eastern District (White Plains, N.Y.).

Leslie H. Warner has been elected president of General Telephone and Electronics Corp., New York City. He succeeds *Don G. Mitchell* who has been elected vice chairman of the board. New president of Sylvania Electric Products Inc., a GT&E subsidiary, is *Gene K. Beare*. At Waltham, Mass., *Dr. James E. Storer* has been named acting director of Sylvania's Applied Research Laboratory to replace *Dr. Leonard S. Sheingold*, who has been appointed chief scientist of the U. S. Air Force. *Dr. Donald B. Brick* has been appointed manager of the laboratory's newly formed information processing group. *Thomas I. Harkins* has been appointed manager of purchasing and contracts for Sylvania Electronic Systems. At Needham, Mass., *Arthur H. Wolfson* has been appointed engineering proposals manager of the Data Systems Operations, and *Charles W. Hosterman* has been named manager of planning. New manager of the subminiature receiving tube plant in Burlington, Iowa, is *Reginald A. Young*. In Warren, Pa., *Eugene E. Broker* has been appointed general manufacturing manager of the nine plants of the Parts Division. *R. R. Goldsborough Jr.* has been named manager of the engineering operations department at Sylvania's Reconnaissance Systems Laboratory in Mountain View, Calif. New general manager of the Sylvania Microwave Device Operations in Mountain View, Calif., and Williamsport, Pa., is *George Konkol*.

Jack Gerber has been appointed sales manager for Industrial-Appliance Wire Products, Wire and Cable Div., Essex Wire Corp., Sycamore, Ill.

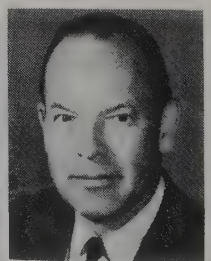
Walter S. Becker has retired as vice president of The Richardson Co., Melrose Park, Ill. He continues as a director and a consultant.

Sylvania Electric Products Inc., subsidiary of General Telephone & Electronics Corp., has appointed *Gerald E. LaRochelle* as manager of the Computer Products Operations' plant in Muncy, Pa. In Waltham, Mass., *Dr. Charles E. Montgomery* has been appointed a research physicist and *Dr. Leonard G. Abraham Jr.* has been named an engineering specialist in the Applied Research Laboratory.

Richard J. Hearty, executive vice president, has been elected president of The Imperial Electric Co., Akron, Ohio.

Harold C. Steadman, with the company since 1958, has been named a director of The Richardson Co., Melrose Park, Ill.

H. C. Steadman



E. W. Vaill

Union Carbide Plastics Co., a division of Union Carbide Corp., New York City, has appointed *E. W. Vaill* technical service consultant.

E. S. Rinehart, Los Angeles branch manager of Spaulding Fibre Co., has retired. At Tonawanda, N. Y., *Roger D. Davies* has been appointed manager of mechanical development, and *Robert L. Chilenskas* has been named director of commercial development. *Paul R. Obergfell* has been appointed manager of Spaulding's Ft. Wayne, Ind., sales branch.

R. L. Chilenskas

P. R. Obergfell

G. H. Meyner, formerly with Westinghouse, has been elected president of The Frink Corp., Brooklyn, and its subsidiary, Sterling Bronze Co.

E. St. P. Bellinger has been named director of operations of the Synthetics Dept., Hercules Powder Co., Wilmington, Del. He succeeds *R. F. Schlaanstine* who has been moved up to the new post of operating manager for the department.

At Permacel, New Brunswick, N. J., *P. R. Trailer* has been named sales promotion training director.

Robert S. Handly and *Worth Tracy*, Continental-Diamond Fibre Co., Newark, Del., have been elected vice president of manufacturing and vice president of employee relations, respectively.

R. S. Handly

W. Tracy

H. Edward Rice has been named vice president, operations of the Government and Industrial Group, Philco Corp., Philadelphia.

Glenwood L. Alsobrook has been named vice president and treasurer of Industrial Electronics Engineers Inc., North Hollywood, Cal.

KENNECOTT-OKONITE MAGNET WIRE BULLETIN 1

This is the first in a series of bulletins on Kennecott-Okonite Magnet Wire. They are designed to keep you informed about the various magnet wire insulations available from Kennecott-Okonite, and to point out the specific advantages derived from each insulation.

KENNECOTT-OKONITE MAGNET WIRE SHAPES

Order any of these insulations in round, square or rectangular shapes to meet your own specific requirements. All Kennecott-Okonite Magnet Wires meet heat classification requirements when tested in accordance with AIEE #57 test procedures.

KENNECOTT-OKONITE MAGNET WIRE PACKAGES

Magnet wire from Kennecott-Okonite is available in a variety of packages. Ask your Kennecott-Okonite salesman to show you the type package that best fits your particular requirements.

AIEE HEAT CLASSIFICATION "A" (105° C or 221° F)

Type Insulation (Film)	Material	Advantages
Plain Enamel	Oleoresinous Black Enamel	General purpose economical insulation.
Formvar	Polyvinyl Acetal	Good windability and flexibility. High thermo-plastic cut-through. Extremely abrasive-resistant.
Bondall	Polyvinyl Acetal plus an overcoat of Thermo-plastic cement	For self-bonding coils requiring no impregnating varnish.
Nylon	Polyamide	Does not solvent-craze; high abrasive resistance.
Nyform	Polyvinyl Acetal film plus an overcoat of Polyamide	Combines better characteristics of Formvar and Nylon with high thermo-plastic flow; does not solvent-craze and is highly abrasive-resistant.

NOTE: Kennecott-Okonite also provides insulations for classifications B, F, O and H, which will be covered in future bulletins.

PROMPT DELIVERY . . . Kennecott-Okonite sales offices, many with stocking warehouses, are located in key cities across the country. Just call the one nearest you for swift service or contact: Kennecott Wire and Cable Division, The Okonite Company, Phillipsdale (Rumford 16), Rhode Island.

KENNECOTT-OKONITE Magnet Wire

Association News

New AIEE Officers

Warren H. Chase, Ohio Bell Telephone Co., has been elected 1961-62 president of the American Institute of Electrical Engineers to succeed Clarence H. Linder.

Elected vice presidents representing various districts were: Thomas E. Marburger, Baltimore Gas and Electric Co., Baltimore, Md.; Benjamin V. Martin, Westinghouse Electric Corp., Charlotte, N.C.; Warren B. Boast, Iowa State University; Charles R. Day, Sacramento Municipal Utility District, Sacramento, Calif.; Leslie J. Weed, Boston Edison Co., Boston, Mass.; Alva A. Johnson, Westinghouse Electric Corp., East Pittsburgh, Pa.; and J. Prescott Skillen, Hamilton, Ont., Canada.

Technical vice presidents elected were: Charles E. Dean, Hazeltine Research Corp., Little Neck, N.Y., representing the Communications Division; Lee R. Larson, Martin Co., Denver, Col., representing the General Applications Division; J. J. Kinghorn, American Power and Service Co., New York, representing the Power Division.

W. R. Clark, Leeds & Northrup Co., Philadelphia, Pa., was re-elected treasurer.

Boston Electronics Symposium Planned for Sept. 21-22

An industrial electronics symposium sponsored by three engineering societies is planned for September 21 and 22 in the Bradford Hotel, Boston, Mass. Sponsors are the American Institute of Electrical Engineers, the Professional Group on Industrial Electronics of the Institute of Radio Engineers, and the Instrument Society of America.

A luncheon speaker will be C. Metcalfe, chairman of the Electronic Forum for Industry, London, England, a British organization recently formed to foster closer liaison between manufacturers and users of electronic equipment.

A highlight of the meeting will be a panel discussion among electronics experts and users of electronic equipment. Moderator will be William Vannah, Foxboro Co., Foxboro, Mass.

Technical sessions are planned on measuring techniques for industry, with Dr. Charles W. Clapp, General Electric Co., as session chairman; digital and analog techniques in industry, with F. W. Atkinson, Owens-Corning Fiberglas Co., as chairman; and new power conversion techniques, with Charles H. Chandler, Gillette Safety Razor Co., as chairman.

NEMA Adds 12 Member Companies

Twelve companies have joined the National Electrical Manufacturers Association in recent weeks.

The new member companies include Aluminum Co. of America, Pittsburgh, Pa.; American Electrical Mfg. Corp., Memphis, Tenn.; The Dahlberg Co., Minneapolis, Minn.; Diamond Expansion Bolt Co. Inc., Garwood, N. J.; The Ebco Manufacturing Co., Columbus, Ohio; Harvey Aluminum (Inc.), Torrance, Calif.; Hatfield Wire & Cable Div., Continental Copper & Steel Industries Inc., Hillside, N.J.; The Puritron Corp., New Haven, Conn.; H. H. Robertson Co., Pittsburgh, Pa.; Royal Electric Corp., Pawtucket, R.I.; Swan Manufacturing Co., Vancouver, Wash.; and Wabash Magnetics Inc., Wabash, Ind.

Call for Papers on Effects of Radiation on Materials

Technical papers on the effects of radiation on materials are being requested for presentation at the Fall General Meeting of the American Institute of Electrical Engineers, October 15 to 20, 1961 in Detroit, Mich.

This session, sponsored by the Radiation Technology and the Radiation Effects on Insulation Subcommittees, will cover the broad scope of effects of radiation, pulsed or steady state, on electrical and electronic equipment.

Authors should submit their names and mailing address, title of the paper, a brief resume (about 25 words), and desired classification (Transaction or Conference paper) as soon as possible. Deadlines for this meeting are as follows: Conference Paper synopses —July 27, and Conference Paper manuscripts—August 11.

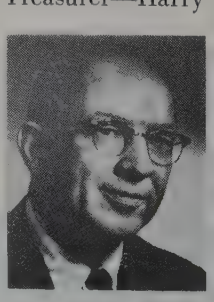
Send resumes to: James C. Fraser, General Electric Co., GEL, #28-100, Schenectady, N.Y.

New Officers for Permanent Magnet Producers

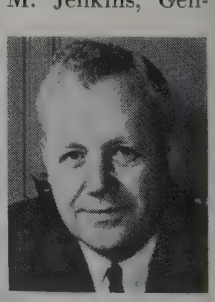
W. G. Sharnberger, Crucible Steel Co. of America, Harrison, N.J., was elected president of the Permanent Magnet Producers Association at the association's annual meeting. PMPA is the national association of the manufacturers of metallic and ceramic permanent magnets. Other officers elected include: W. E. Gilman, General Magnetics Corp., Chicago, vice president; and H. R. Bulmore, Simonds Saw and Steel Co., Lockport, N.Y., treasurer.

New SPI Officers

The Society of the Plastics Industry Inc. has elected new officers and directors. They are: Director and Chairman of the Board—Russell C. Weigel, E. I. du Pont de Nemours & Co. Inc.; Director and President—Walter F. Oelman, Standard Molding Corp., Dayton, Ohio; Director and Vice President—T. T. Miller, W. R. Grace & Co.; Director and Secretary-Treasurer—Harry M. Jenkins, Gen-



W. F. Oelman



R. C. Weigel

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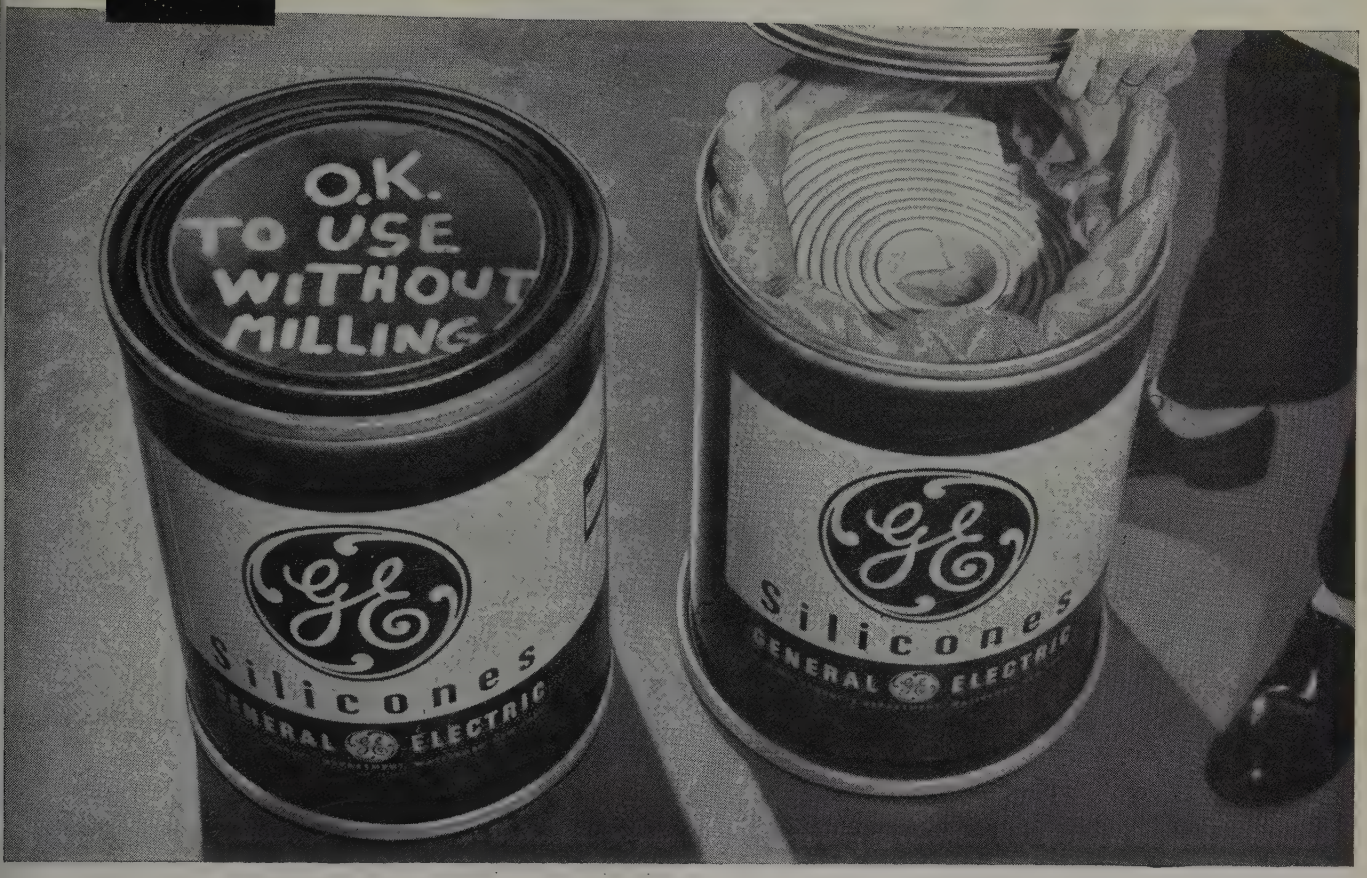
Three months on the shelf...

YET NEW SE-9008 SILICONE RUBBER WIRE AND CABLE COMPOUND CAN STILL BE USED WITHOUT MILLING!



General Electric's non-milling silicone rubber compound SE-9008 is the *only* quality wire and cable compound you can buy that keeps freshened life *for three full months!* You can now cut way down on your processing costs, and provide wire and cable with high performance capabilities at moderate cost.

SE-9008 comes in coiled "hats" ready to feed *automatically* into your extruder. No premilling, no modifications, no special dies required.

Strips comes 2" wide, and either ½" or ¼" thick, whichever you require. Available for either hot air or steam vulcanization.

SE-9008 is excellent for power cable, fixture wire, motor and apparatus wire, and other commercial and military applications.

SE-9008 is moderately priced, and possesses good electrical and physical properties. Meets Underwriters Laboratory requirements for silicone rubber insulated fixture wire.

SE-9008 is another cost-saving product from General Electric, who supplies more silicone rubber for wire and cable insulation than all the other suppliers *combined!*

For more information on SE-9008, write: General Electric Company, Silicone Products Department, Section M751, Waterford, New York.

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eral American Transportation Co.

The SPI also elected the following Sectional Directors: Canadian Section—Adolph Monsaroff, Monsanto Canada Ltd.; New England Section—John W. LaBelle, Foster Grant Co. Inc.; Western Section—J. Allen Carmien, Nupla Manufacturing Co., Div. New Plastic Corp.

In addition, Industry Division and Committee Directors were named. They are: Cellular Plastics Division—Samuel Steingiser, Mobay Chemical Co.; Code Advisory Committee—Frank X. Ambrose, Alsynite Div., Reichhold Chemicals Inc.; Custom Molders Division—Donald F. Dew, Diemolding Corp.; Fluorocarbons Division—Victor G. Reiling, Modern Industrial Plastics Inc.; Machinery Division—William H. Bennett, The Hydraulic Press Manufacturing Co.; Mold Makers Division—W. H. Monteith, Akromold Inc.; Profile Extruders Division — Milton J. Lax, Kreidel Plastics Inc.; Public Relations Committee—Robert W. Boggs, Union Carbide Plastics Co., Div. Union Carbide Corp.; Thermoplastics Pipe Division—George H. Reed, American Hard Rubber Co., Div. Amerace Corp.; Vinyl Film Manufacturers Division—Bernard Mittman, Elm Coated Fabrics Co. Inc.; Reinforced Division—Samuel A. Moore, Interchemical Corp.

The following were elected Directors at Large: Thomas F. Anderson, Haveg Industries Inc.; Philip J. Arnoff, Transparent Specialties Corp.; Morton Davis, Joseph Davis Plastics Co.; Henry DeVore, Plastics Div., Allied Chemical Corp.; Harold Dinges, Plastics Div., Spencer Chemical Co.; F. Norman Hartmann, Lily-Tulip Cup Corp.; William Marsh, U. S. Industrial Chemicals Co., Div. National Distillers & Chemical Corp.; Robert Morehouse, Kent Plastics Corp.; John H. Woodruff, Auburn Plastics Inc.

WESCON Field Trips

The field trips program of the Western Electronic Show and Convention to be held at the Cow Palace, San Francisco, includes the following tours: Tuesday afternoon, August 22—Litton Industries' Electron Tube Division at San Carlos and the University of California's Lawrence Radiation Laboratory at Livermore (this tour limited to 50). Wednesday afternoon, August 23—Stanford University Microwave Laboratory and the joint Radio Field Site of Stanford University and Stanford Research Institute. Thursday morning, August 24—MELABS, in Stanford Industrial Park at Palo Alto. Thursday afternoon, August 24—Hewlett-Packard Co. and its newly expanded center in Stanford Industrial Park.

Hibler Named President of Manufacturing Engineering Council

At the second annual meeting held in Lafayette, Ind., the Manufacturing Engineering Council elected Harry C. Hibler, Designers for Industry Inc., to replace Frederick I. Ellin, Ohmite Manufacturing Co., as national president. Walter A. Stadtler, IBM Corporation, was elected vice-president.

The Manufacturing Engineering Council, with executive offices at 2490 Lee Blvd., Cleveland 18, Ohio, is a national professional society for key management and engineering personnel in manufacturing.

Baechle Named Acting Executive VP for EASA

August A. Baechle has been named acting executive vice-president of the Electrical Apparatus Service Association, Inc., pending appointment of a permanent EASA manager by the association's board of directors.

Baechle temporarily succeeds Joseph M. Harrington, who resigned May 2. The resignation of Kenneth B. Mitchell, Jr., office manager, has also been accepted.

Exhibit Space Sold Out at Chicago Electronics Conference

All exhibit space at the 1961 National Electronics Conference, to be held at Chicago's International Amphitheatre on October 9-11, has been sold. New firms applying for exhibit space are being placed on a waiting list.

The 1961 conclave is expected to be the largest display and meeting of electronic industry ever held in the Midwest. Among exhibitors are firms from Canada, England, and Japan. A broad range of electronic products will be displayed in over 400 booths (about a mile of exhibits). Approximately 400 electronic firms will be represented.

Attendance at the forums on electronic research, design, and application is expected to reach 18,000.

New Companies Join IPC

The Institute of Printed Circuits reports that 13 additional companies have joined the Institute this year. They include: Defiance Printed Circuit Corp., International Resistance Co., Burroughs Corp., General Electric Co. (Defense Electronics Div.), Teletype Corp., Western Electric Co., IBM (Command Control Center), AMP Inc., ELCO Corp., The Formica Corp., Owens-Corning Fiberglas Corp., Edward Segal, and Sel-Rex Corp.

The next general meeting of the IPC will be held in Chicago, October 10-11, 1961. For information write to the IPC office, 27 E. Monroe, Chicago.

Plan Magnesium Oxide Symposium

At the organizational meeting of the Heating Unit Insulation Testing Committee in Chicago on January 12th, this group decided to sponsor a Third Magnesium Oxide Symposium. Tentatively, it is planned to hold it in connection with an annual meeting of the Testing Committee early in February, 1962. Although the meeting place has not been established, Pittsburgh has been suggested.

A two-day meeting is being considered. The first day would probably be devoted to a general business meeting of the committee, with reports from each of the sub-committees on their progress in establishing

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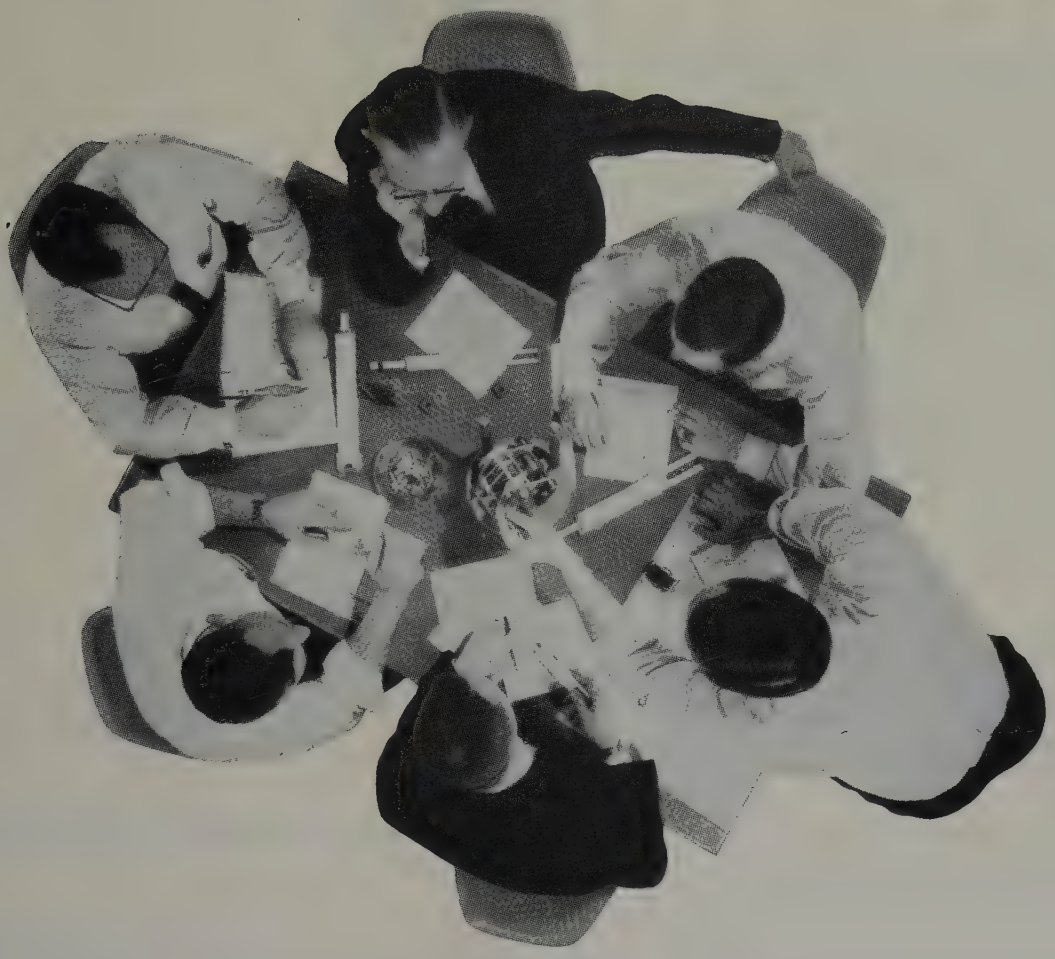

. . . with Spaulding Value Analysis Engineers putting their heads together over your product

Spaulding interprets the Value Analysis Process as "a scientific method of accomplishing a function at the lowest possible cost."

That's why Spaulding maintains specially trained Value Analysis Engineers on its sales staff who evaluate a customer's product, then decide how it can be made better, easier, and at a lower cost through the use of a Spaulding material processed by Spaulding's own Fabricating Department.

These men save Spaulding's customers thousands of dollars annually. Why not let them put their heads together for you?

The Unique Characteristics of these Spaulding Materials and Services Hold Important Advantages for your product.

Spaulding Vulcanized Fibre: Hard, dense, extremely wear-resistant. One of the best arc-resistant, electrical and heat insulators known to industry.

Spauldite: Industrial plastic laminates.

Spauldo: A 100% rag paper electrical insulation used as motor slot insulation.

Spaulding T: A very high grade fibre board. Also known as Pressboard, Transformer Board and Fuller Board.

Spaulding Armite: An improved thin vulcanized fibre insulation (fish paper).

Spaulding Fibre Board: Made by the wet process from selected fibrous materials in various grades, including resin boards.

Fabrication Facilities: Undivided responsibility from manufacturer to finished part, with the most complete fabricating facilities in the industry

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standard tests. The technical sessions would take place on the second day.

Papers are being solicited and inquiries should be directed to R. L. Moncrief, Heating Insulation Testing Committee, Manufacturing Research Lab., Plant Three, Frigidaire Div., General Motors Corp., Dayton 1, Ohio.

Industrial Electric Exposition

"Power Up for Progress and Profit" is the theme of the Eighth Industrial Electric Exposition sponsored by the Electric League of Western Pennsylvania and scheduled for November 7-9, 1961, in the Pittsburgh Room of the Penn-Sheraton Hotel, Pittsburgh. Its objective is to acquaint those in industry who specify, buy, and use electrical equipment with the most modern electrical tools for improving plant efficiency.

Western Space Age Exposition

A new industrial product display, known as Western Space Age Industries and Engineering Exposition, has been scheduled for the Cow Palace at San Francisco, April 25-29.

It is being sponsored by top western industrialists in cooperation with the governors of the 13 western states, the U. S. Defense Department, and other government procurement agencies.

Templeton Elected Representative To Electronic Industry Show

Earl Templeton, P. R. Mallory Co. Inc., has been elected one of the two representatives of the Electronic Industries Association on the board of directors of the Electronics Industry Show Corp. Templeton was named to succeed Norman A. Triplett, Triplett Electrical Instrument Co. Harold Bersche, Radio Corporation of America, is the second EIA representative.

The show corporation's board of directors conducts the Electronic Parts Distributors Show held annually in May for the benefit of distribution personnel. EIA is a co-sponsor of the show, along with the Western Electronic Manufacturers Association, Producers of Associated Components for Electronics, Inc., and the Association of Electronic Parts and Equipment Manufacturers, Inc.

Letters to the Editor

Sunnyvale, Calif.

"In the May issue of *Insulation*, figure 1 of the article on 'The Folklore of Encapsulation' typifies more folklore. The heat cycling failures result from the differences in the thermal expansions of the copper eyelet, solder, and the phenolic board. The ratio of expansions in the Z direction is close to 9 to 1; regardless of the amount of solder, the solder shear failure will occur eventually with thermal cycling."

—C. E. Harthun, Design Specialist, Missiles and Space Div., Lockheed Aircraft Corp.

New York City

"As consultants in the electrical field we often encounter the following problem and its variations:

"Suppose manufacturer 'A' produced a high voltage transformer and sold it to customer 'B'. This transformer meets the incoming inspection tests of Mil-T-27A, including the insulation resistance test, being a minimum of 10 kilomegohms. It is designed for 10,000 hours and guaranteed by manufacturer 'A' for one year.

"After being operational for, let us say ½-year, it is damaged by accident . . . somebody cracks a terminal or something similar. The manufacturer will charge for the repair because this is not covered by the guarantee conditions.

"After completion of the repair, the unit does not measure 10 kilomegohms anymore because during the operational period the insulation deteriorated and the residuals went into the paper. The insulation resistance value therefore has dropped somewhat and reads around 6-8 kilomegohms.

"There is no question but that this transformer will easily outlast its original 10,000 hours. However, the incoming inspection of plant 'B' rejects the unit now per insulation requirements of Mil-T-27A.

"My question is: Are they justified in doing so, or does the specification allow deterioration during operation in proportion to life expectancy as long as it does not interfere with the proper functioning of the unit?"

Readers' comments are invited.

—H. B. Farensbach, Consultant, Electro & Transformer Consultant Association Co.

A drunk fell from a two-story window and hit the pavement with a terrific impact. A crowd gathered and as the drunk staggered to his feet someone grabbed him by the arm and asked, "What happened?"

To which the drunk replied: "I dunno; I just got here."

New Publications

Books

Electronic Drafting Handbook, by Nicholas M. Raskhodoff. Shows how to prepare every kind of electronic drawing and contains finished sample drawings, photographs, and figures. Typical drafting-room practices, techniques, and checking procedures are covered. Hard cover, 402 pages, $14.75. The Macmillan Co., 60 Fifth Ave., New York 11.

Source Book of the New Plastics—Volume 2, by Herbert R. Simonds. Covers properties, production, price, use, and selection, and provides data on improvements in established materials, producers' new materials, borderline and secondary plastics, technical progress, and federal-sponsored research. Hard cover, 310 pages, $8.95. Reinhold Publishing Corp., 430 Park Ave., New York 22.

Nondestructive Testing, by Warren J. McGonnagle. Covers test methods, principles, and modern techniques. 457 pages, 6″ x 9″, 413 illustrations, 65 tables, $15. McGraw-Hill Book Co., 330 W. 42nd St., New York 36.

Electronic Specifying and Purchasing. Lists over 10,000 firms engaged in the manufacture, sale, and distribution of electronic components and equipment. More than 60,000 separate listings. 1,000 pages. Electronic Periodicals Inc., 2775 S. Moreland Blvd., Cleveland, Ohio.

Standards of the Alumina Ceramic Manufacturers Association. Provides basic information about the properties, production, design, and effective use of ceramic materials and parts. Test methods, resistance to nuclear radiation, quality assurance standards, dimensional tolerances, and metalizing are also covered. 16 pages, $1. Alumina Ceramic Manufacturers Assn., 53 Park Place, New York 7.

Government Publications

The following listed publications should be ordered by number from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Basic Electricity. Revised training manual for naval personnel. 488 pages, $3.50. Order Catalog No. D208.11:El 2/3/960.

Units of Weights and Measures (United States Customary and Metric)—Definitions and Tables of Equivalents. National Bureau of Standards Miscellaneous Publication 233 (supersedes Miscellaneous Publication 214). 20 pages, 40 cents.

Publications of the National Bureau of Standards, July 1957 to June 30, 1960. NBS Miscellaneous Publication 240, issued May 3, 1961. 391 pages, $2.25.

TS-5528, *Recommended Commercial Standard for TFE-Fluorocarbon Resin Sheet.* Available on request from the Commodity Standards Div., U. S. Dept. of Commerce, Washington 25, D. C.

The following publications should be ordered by number from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

PB 171 187, *Notes on the Relationship of Temperature and Resistance,* by J. Pearlstein. 9 pages, 50 cents.

PB 171 416, *Heat Protective Ablative Coatings for Radomes,* by J. F. Cavanaugh and J. P. Sterry. 85 pages, $2.25.

PB 161 956, *Thermal Protection of Structural Propulsion, and Temperature-Sensitive Materials for Hypersonic and Space Flight,* Part I—Relative Performance of Ablating Materials Exposed to Low and High Heat Flux Environments, by J. H. Bonin and C. F. Price. 62 pages, $1.75.

PB 171 054, *Analysis of Relative Performance of Ablating Materials Compared to a Heat Sink Material,* by R. E. Otto. 13 pages, 50 cents.

PB 161 670, *Compliant Electrodes for Dielectric Measurements,* by Andrew R. Blanck. 15 pages, 50 cents.

PB 171 364, *Synthesis and Purification of Dielectric Materials,* by W. C. Divens and others. 77 pages, $2.

PB 171 494, *Handbook of Fibrous Materials,* by H. Mileaf. 495 pages, $6.

PB 161 785, *Synthesis of Resorcinol-Epoxy Adhesive and Evaluation of Its Mechanical Properties,* by H. T. Lee and others. 10 pages, 50 cents.

PB 171 074, *Surface and Environmental Effects on Ceramic Materials,* by P. Gibbs and others. 24 pages, 75 cents.

SB-451, *Low Temperature Research on Materials* (selected bibliography). 10 cents.

SB-453, *High Temperature Research* (selected bibliography). 10 cents.

PB 171 193, *Protective Coatings for Refractory Metals,* by C. G. Bergeron and others. Evaluates various ceramic coatings for tungsten metal. 45 pages, $1.50.

PB 161 969, *Ozone Resistance of Elastomeric Vulcanizates at Elevated Temperatures,* by C. O. Crozier. 15 pages, 50 cents.

AIEE Standards

The following listed standards publications may be obtained from the American Institute of Electrical Engineers, 33 West 39th St., New York 18.

43, Recommended Guide for Testing Insulation Resistance of Rotating Machinery. $1.

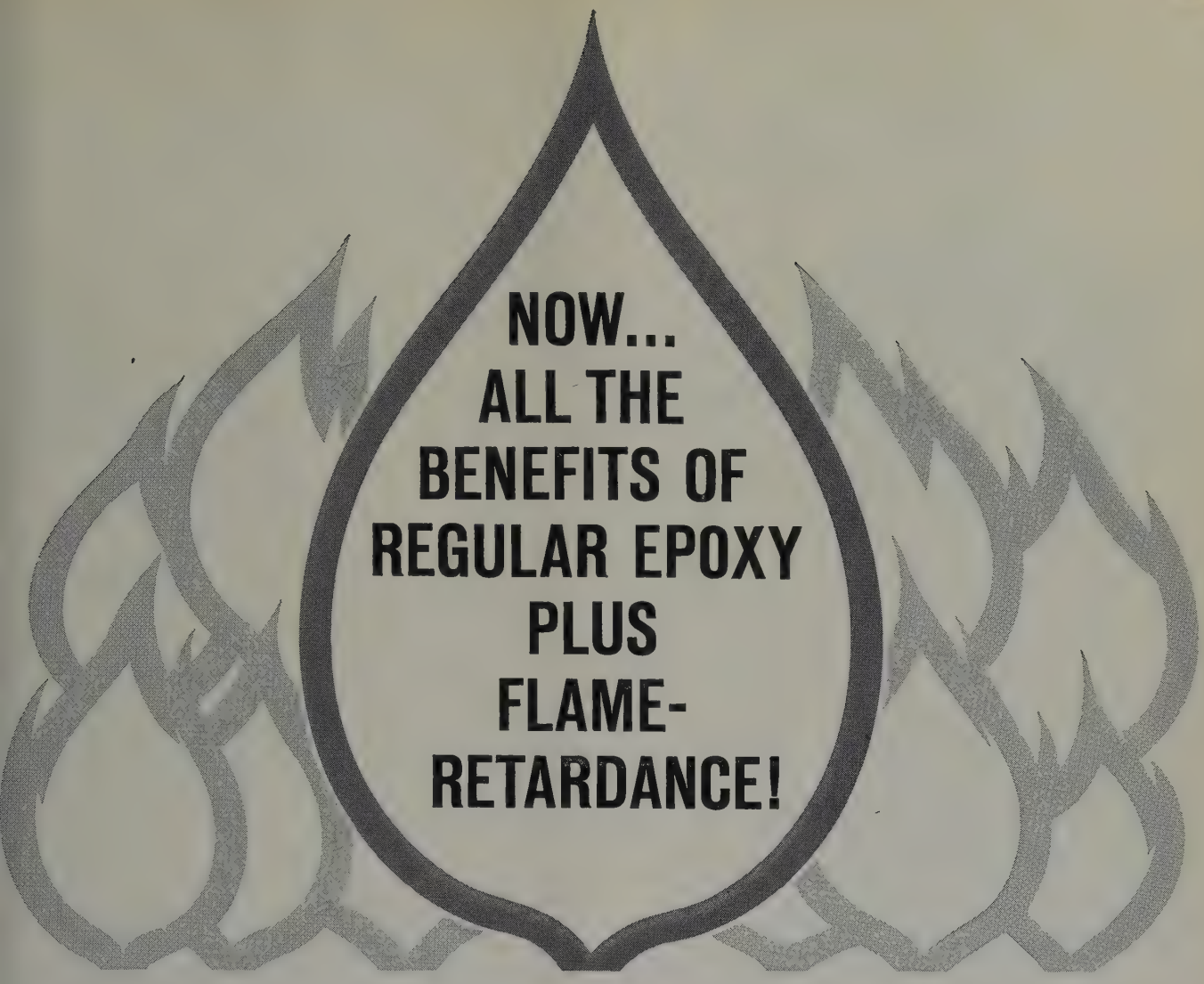
80, Guide for Safety in Alternating-Current Substation Grounding. $11.

86, Proposed Standard Definitions of Basic Per Unit Quantities for Alternating-Current Rotating Machines. 50 cents.

C37.7, American Standard Interrupting Rating Factors for Reclosing Service on Power Circuit Breakers. 40 cents.

C57.12.00a, Supplement to American Standard Requirements, Terminology, and Test Code for Distribution, Power, and Regulating Transformers, and Reactors Other Than Current-Limiting Reactors, Section 12.00, General. 40 cents.

Y14.15, American Drafting Standards Manual, Section 15, Electrical Diagrams. $1.50.



New from Union Carbide Plastics: Flame-retardant Bakelite Epoxy Resin ERL-0625! Provides excellent flame-retardant, hot-melt casting and dry lay-up laminating systems when combined with aromatic amine or anhydride hardeners.

Manufacturers of television components, appliances, and the many other electronic and electrical products now specify more than excellent electrical and mechanical properties. They require flame-retardance of the insulating materials they use. This new Bakelite epoxy meets all electrical laminate and embedding requirements for giving superior protection to delicate components—with the added "plus" of flame-retardance.

Compounds based on flame-retardant Bakelite ERL-0625 have high impact strength, resist heat, moisture and chemicals. They can be formulated to meet specific operating needs.

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HG-28 Laminate/ERL-0625 . . . S. E. (self-extinguishing) in 7 sec.
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*Resin content was 31-34%. Laminates were pressed 1 hr. @ 320° F. and postcured 8 hrs. @ 320° F. Hardened with p,p'methylene dianiline.

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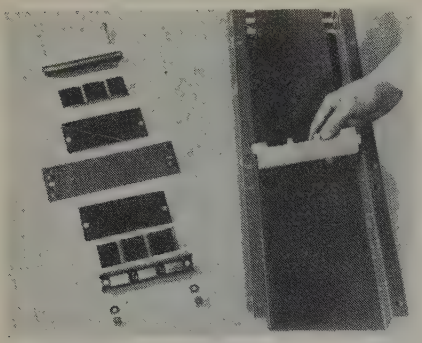


Figure 1, busway assembly time is cut 50 percent by switching from multi-piece steel brackets to one-piece polyester glass laminate bus bar supports. Plastic supports slip into stamped slots in enclosure.

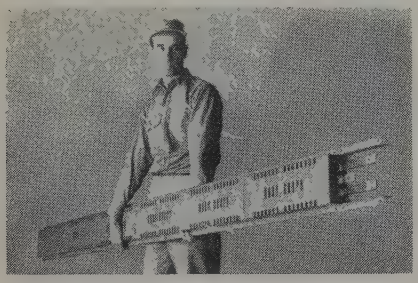


Figure 2, polyester spacers have cut busway weight 30 percent. Formerly, 600 amp, 3-pole plug-in aluminum busway weighed about 80 pounds; "Polyair Insulation" units weigh only 55 pounds.

Figure 3, polyester spacers also provide a minimum of 7/8-inch insulation spacing to ground. Combination of polyester insulators and insulating air space contributes to significant reduction in electrical hazards.

A simple design change in busway construction — switching from insulated metal brackets to more expensive one-piece polyester glass insulators for bus bar supports—increased insulation spacing to ground for added safety, cut busway assembly time 50 percent, and lowered the weight of the complete line by an average of 30 percent.

Although the polyester spacers cost about 29 percent more than the insulation used with metal brackets, they are said to produce a net saving because of the 50 percent reduction in assembly time.

The firm, Electric Distribution Products Inc., Allentown, Pa., a division of Worthington Corp., now uses polyester glass laminate spacers on its complete "Uni-Bus" line of busways for 60 to 4,000 ampere service. The new construction is called "Polyair Insulation" because of the combination of polyester insulators and increased insulating air space which provides a minimum of 7/8-inch of insulating spacing to ground. Underwriters Laboratories minimum is 1/2-inch.

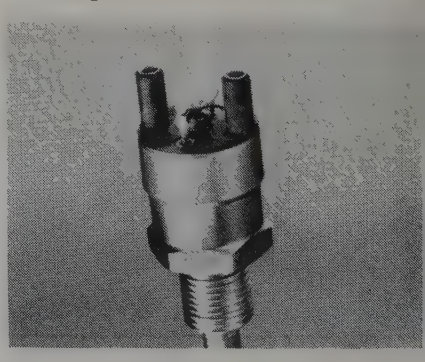
The material used in the new spacers is "Phenolite" GP-9206 polyester fiber glass laminated plastic made by National Vulcanized Fibre Co., Wilmington, Del. Each spacer is a single piece of material, approximately 6 inches long and 1/4-inch thick. They are punched from polyester sheets. The added cost of molding is not justifiable in this case because of the possibility that the size and configuration of spacers may vary, making short run planning a necessity.

The laminate has excellent electrical properties for this application. Insulation resistance is 125 megohms under ASTM method D-257 while arc resistance is 100 seconds under ASTM method D-495. In addition, the material is flame-resistant; a 1/2-inch thick specimen tested under NEMA's switchgear condition takes 75 seconds to ignite and is self-extinguishing. These properties, combined with the use of varnished cambric tape and polyvinyl chloride tape for conductor insulation, enables the Uni-Bus busway to safely withstand the effects of repeated high voltage surges or circuit faults.

Under other ASTM methods, good mechanical properties are also shown. Tensile strength lengthwise and crosswise is rated at 12,000 psi and 10,000 psi respectively. Compressive strength of flat sections is rated at 30,000 psi. Shear strength flat is 10,000 psi. These mechanical properties provide the rigid bracing needed to prevent busway explosions when severe mechanical stresses are set up by the momentum of circuit faults. In addition, the polyester supports withstand rough handling better than conventional ceramic supports which require careful handling to avoid chipping and breakage.

Ceramic-to-Stainless Steel Hermetic Seal

A metal-to-ceramic hermetic seal in the Nike-Hercules missile is accomplished through a design that utilizes the mismatch of expansion coefficients of the ceramic and the stainless steel housing to advantage. Mitronics Inc. developed the new unit for a high temperature thermal switch in the auxiliary power unit of the missile. The switch, made by Control Products Inc., can operate effectively in temperature environments up to 1750°F and can even withstand temporary overshoots in heat up to 2200°F. The 115 volt, a-c/d-c device weighs only 2 ounces and switches a current of up to 1 ampere.



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3-1-0

Industry News

Gold Seal Products Corp. has changed its name to *Kulka Electronics Corp.*, elected Eugene R. Kulka to its board of directors, and made *Kulka Electric Corp.* a subsidiary. *Kulka Electric* manufactures terminal blocks and switches.

Tri-Point Industries Inc., Albertson, L. I., N. Y., has reported 1960 sales of $1,931,105, a gain of 19% over the previous year.

A $600,000 expansion and development program is under way at the Richmond, Ind. plant of *Johns-Manville Corp.*

SEG Electronics Co. Inc., Brooklyn, N. Y., has acquired *Solar Electronics Corp.* for an undisclosed sum. Solar will be operated as a wholly-owned subsidiary.

Sierra Electric Corp., Gardena, Cal., has purchased for an undisclosed sum all rights, inventories, and tooling for the low-voltage electrical control systems currently produced by the *Square D Co.*, Cedar Rapids, Iowa.

Texas Gas Transmission Corp. has acquired controlling interest in *Kentucky Electronics Inc.*, Owensboro, Ky.

General Electric Co. has appointed *Smooth-On Mfg. Co.*, Jersey City, N. J., distributor of its RTV silicone rubber. The *G-E Silicone Products Dept.* has opened a sales office in Burlingame, Cal., and the industrial sales office of the *Laminated Products Dept.* has been relocated from New York City to Belleville, N. J.

The *Data Systems Div.* of *American Electronics Inc.*, Brooklyn, N. Y., has been acquired by *American Datamatic Inc.*, Hicksville, L. I., N. Y.

Pall Corp., Glen Cove, N. Y., has merged with *Trinity Equipment Corp.*, Cortland, N. Y. Trinity will be operated as a wholly-owned subsidiary.

Stockholders of *Swan Rubber Co.*, Bucyrus, Ohio, have approved the acquisition of Swan by *Amerace Corp.*, New York City, for $22,220,400 in cash.

On July 1, 1961, *Food Machinery & Chemical Corp.* changed its name to *FMC Corp.*

Michigan Chrome and Chemical Co., Detroit, has acquired *Allied Research & Engineering Co.*, Hollywood, Cal., as a wholly-owned subsidiary.

An agreement of mutual support in the engineering and marketing of automated control systems and processes has been reached by *Allis Chalmers Mfg. Co.*, *Consolidated Systems Corp.*, and *International Business Machines Corp.*

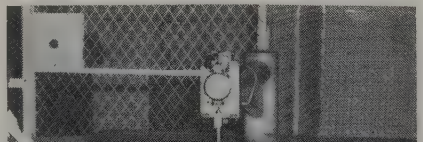
Stockholders have voted to change the name of *Gold Seal Products Corp.*, New York City, to *Kulka Electronics Corp.*

D. J. Borodin and J. E. Campbell, formerly with *Allied Research Products Inc.*, have formed a new company, *U. S. Automation Co.* in Detroit, Mich.

Isochem Resins Co., Providence, R. I., has appointed three new representatives, *Panther Sales Co.*, Paterson, N. J., for the New York and New Jersey area; *Claude Michael Inc.*, Glendale, Cal., for the West Coast; and *Garland-White & Co.*, Oakland, Cal.

Estey Electronics Inc., Torrance, Cal., and *Organ Corp. of America*, West Hempsted, N. Y., have merged. The new company will be known as *Estey Electronics Inc.*

A new tester, designed to accurately measure thickness of any portion of a



standard size laminated sheet, has been put into operation by *Synthane Corp.*, Oaks, Pa.

Pemco Corp., Baltimore, Md., has formed a new division, *The Applied Ceramics Division.*

New England Instrument Co., Waltham, Mass., has entered the microwave components field.

Miller-Stephenson Chemical Co. Inc., South Norwalk, Conn., has opened a new midwestern sales office and warehouse in Chicago.

Thermoplastic Processes Inc., Stirling, N. J., has added 6,000 sq ft of new plant facilities.

The *Complete-Reading Electric Co.*, Chicago, has established a Kansas City branch known as *Complete Reading Electric Co. Inc. of Missouri.*

The *Electronic Tube Div.* of *Sylvania Electric Products Inc.*, a subsidiary of General Telephone & Electronics Corp., will discontinue operations at its Houtzdale, Pa. sub-assembly plant and transfer its production to other facilities within the division. At Waltham, Mass., a new *Applied Research Laboratory* facility and a

new headquarters building for *Sylvania Electronic Systems* are near completion. The two 2-story buildings will total approximately 115,000 sq ft. The *Parts Div.* of Sylvania has opened a new plant in Warren, Pa.

A new plant to serve the West Coast has been established by *Emerson & Cuming Inc.* at Gardena, Cal.

Dean Plastics Inc., Closter, N. J., has expanded plant facilities to machine "Pyroxy" high-heat resistant plastics.

Westinghouse Electric Corp. has named *Angus-Campbell Inc.*, Los Angeles, distributor for its insulating materials.

Asbestos Corp. of America, Garwood, N. J., has been appointed exclusive eastern seaboard sales agent for Havestos, a product of *Haveg Industries Inc.*, Wilmington, Del.

National Beryllia Corp., Haskell, N. J., has named *R. S. Pettigrew & Co. Inc.* technical sales representative in the New England states.

Permali Inc., Mount Pleasant Pa., has appointed the *J. J. Glenn Co.*, Chicago, as sales agent for the Midwest.

STEVENS GLASS FABRICS

NOW! THIN-WRAP—HIGH DIELECTRIC STRENGTH

Stevens POLYGLAS* coating fabric provides voltage protection with *FEWER* and *THINNER LAYERS!* Thanks to Glass and Dacron® Polyester, Polyglas can be stretched to conform to intricate contours without opening or tearing, providing the smoothest base possible in woven insulation for cable overwrap. Dielectric properties actually increase after Polyglas coated tape is wound and stretched.

Polyglas is available as a base coating fabric in two-, three-, and four-mil thicknesses in lengths up to 1,500 yards per roll.

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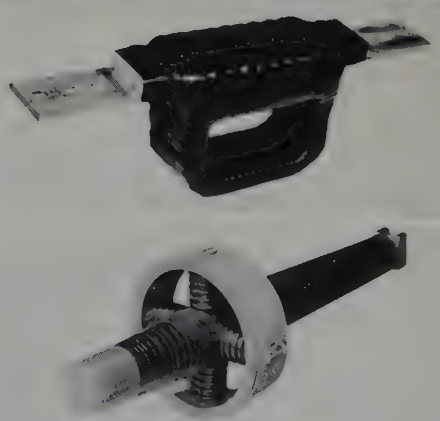
Stevens rigid testing and production control assure uniformly high standards and close tolerances.

Write or phone for suppliers of Polyglas coated fabric or tapes.

*64% Glass/36% Dacron® Polyester



Current Transformer (top), Power Distribution Bus (bottom) illustrating two of the many taping operations for Teraglas† made with Stevens new Polyglas fabric. †T.M. Natvar Corp.

J. P. Stevens & Co., Inc.

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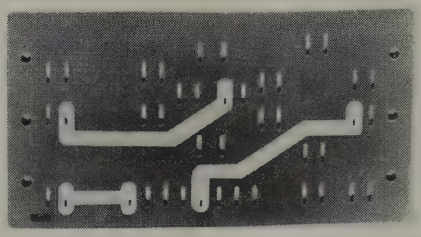
Flame-Retardant Glass-Epoxy Laminate

A new glass-base, epoxy-resin laminated plastic which is self-extinguishing, known as "Fireban" 600, is available in sheets and can also be supplied with copper cladding (Fireban 600 E) for making printed circuits. The NEMA equivalent for Fireban 600 is FR-4. Both Fireban materials meet a number of military specifications. Other features of Fireban 600 reported are high mechanical strength, excellent electrical properties under high humidity conditions, and low moisture absorption. It also is said to have high interlaminar bond strength and good chemical resistance. Fireban 600 sheets are approximately 37″ x 49″ and are supplied in a thickness range of .010″ to 2″. Sheets up to 1/16″ thickness may be cold punched. Finish is semigloss. Bond strength. condition "A", for the copper clad sheets is 8 lbs for 1 oz cladding, 10 lbs for 2-oz cladding, 12 lbs for 3-oz cladding, and 14 lbs for 5-oz cladding. No blistering is reported on Fireban 600 E when the material is floated copper side down in solder at 500°F (260°C) for 20 seconds, nor when it is held in an oven at 284°F (140°C) for 60 minutes. Bulletins Nos. 51.5.20 (Fireban 600) and 51.5.21 (Fireban 600 E) available. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 101 on Reader Service Card

Printed Circuits for 1300°F Use

High reliability printed circuits have been developed utilizing a 97% alumina base with a fired molybdenum-manganese circuit pattern. Manufacturing controls are stated to be so accurate that as many as five circuit paths may be produced in a ¼″ square area with circuit paths separated by as little as .005″. The molybdenum-manganese circuit wiring, permanently bonded to the ceramic base, reportedly cannot be removed without destroying the ceramic which withstands 20,000 psi, nor can it be broken or shaken from the circuit board. Frequent field changes, such as the addition or removal of jumper wires, can be made without harm to the circuitry. A printed circuit created by the new technique is said to operate in temperatures as high as 1300°F and to return to its original shape after exposure to high temperatures. It is also claimed that these circuits will not be harmed by arcing, will not absorb moisture, and operate in the presence of corrosive liquids. Ceramics International Corp., 39 Siding Place, Mahwah, N. J.



Print No. Ins. 102 on Reader Service Card

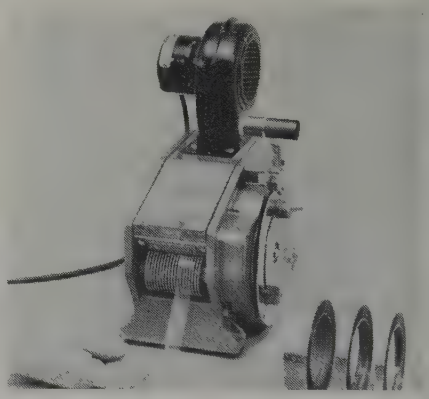
Strong, Flexible Tubing of 'Teflon' And Spiral-Wrapped Tape

The physical properties of Teflon and the strength of a spiral wrapped tape are provided in a new flexible tubing for electrical insulating applications. Called "Penntube" 1-SW, the tubing has high burst strength and resistance to ripping or cracking. It also features close inside diameter tolerance control, concentricity, and tight bend radius without kinking. The tubing meets the requirements of MIL I 3190. Properties reported include: service temperature range from below —90°C to greater than +250°C, high dielectric strength, flexibility at low temperatures, resistance to penetration, no change of electrical properties with either temperature or frequency, low dielectric constant (2.0), and low dissipation factor (0.0002). Pennsylvania Fluorocarbon Co. Inc., 1115 N. 38th St., Philadelphia 4, Pa.

Print No. Ins. 103 on Reader Service Card

Clear 1-Mil Polyester Tape For Class B Insulating

A .001″ clear polyester film coated on one side with a transparent, thermosetting, pressure-sensitive adhesive, called "Scotch" brand electrical tape No. 54, is designed for continuous operation at class B (130°C) temperatures. Typical applications include coil cover and inter-layer insulation, slot liner, slot edging, capacitor and transformer insulation and lead holding. The transparent adhesive is non-corrosive. When thermoset, it reportedly resists most solvents, waxes, varnishes, and chemicals; will not soften at high temperatures or "throw out" when used in high speed rotating equipment. The adhesive provides high tack and good initial adhesion for holding and protecting parts during production. The thin backing is conformable to irregular shapes. The strength that is characteristic of polyester films is said to be preserved by avoiding edge nicks during slitting. Properties reported include electric strength of 4,500 v; tensile strength of 30 lb/in; insulation resistance of



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Vartex resinous tapes, having exceptional elongation properties, are well suited for taping, harnessing irregular surfaces, bus bars and lead wires. These tapes have excellent physical properties, high dielectric strength, and are not affected by acids, oils or grease. They have unusual ability to heat seal upon themselves and will not support combustion.

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"VARSIL" Silicone Varnished "Fiberglas"† Cloth and Tapes

"VARSLOT" Combination Slot Insulation:
Rag Paper and Vartex Varnished Cambric
Fish Paper and Vartex Varnished Cambric
Rag Paper and "Mylar"* Polyester Film
Asbestos Paper and "Mylar"* Polyester Film
Kraft Paper and "Mylar"* Polyester Film
Vartex Varnished "Fiberglas"† and "Mylar"* Polyester Film
Special combinations available upon request

*Mylar, Du Pont's registered trademark †Fiberglas, Owens-Corning Fiberglas registered trademark

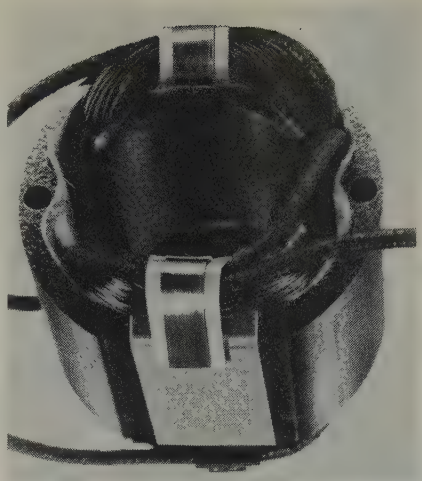
Print Ins. 27 on Reader Service Card

1×10^6 megohms; electrolytic corrosion factor of 1.0; and overall caliper of 2.5 mils. Photo shows the tape in the M-851 definite length dispenser with blower attachment. Air flowing around the roller suspends thin caliper tapes for easier grasping, faster handling on production lines. Dept. W1-237, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 104 on Reader Service Card

Improved Coil Retainer Stock

An improvement in the use of "Perma-Form" as coil retainer stock in fractional horsepower motors is said to have eliminated the need for additional insulation inserts between the coil and stator. Perma-Form is a combination of 0.010″ rag-paper bonded with rubber-resin adhesive to No. 3 temper, No. 4 round edge, 0.022″ by ¼″ flat rolled wire. The rag-paper was widened to ¾″ to not only strap the coil, but also to prevent it from contacting the stator. The ends of the strap are trimmed back to 7/16″ width to facilitate bending.



Dielectric strength of approximately 300 vpm for the rag-paper strip and 500 vpm for the rubber-resin adhesive are claimed, with a one mil adhesive thickness being used. The strapping is machine formable and is shipped on 24″ disposable reels. W. J. Ruscoe Co., Laminating Div., 483 Kenmore Blvd., Akron 1, Ohio.

Print No. Ins. 105 on Reader Service Card

Electrical Tape Dispensers In Two Smaller Sizes

The "Flip-N-Cut" instant dispenser-cutter for "Slipknot" plastic electrical

tape is now available in three sizes. The original Flip-N-Cut dispenser introduced last year was designed for a 66′ x ¾″ roll. New units handle a 44-ft and a 30-ft roll. Dispensers are free with purchase of the tape. Plymouth Rubber Co. Inc., Canton, Mass.

Print No. Ins. 106 on Reader Service Card

Cold Stripper for Photo Resist On Printed Circuit Boards

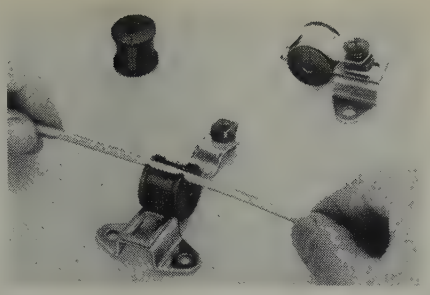
A new, improved cold stripper for removing photo resist from printed circuit boards and chem-milled parts, called Stripper 77, reportedly works quickly, eliminates coagulation problems, and offers cost advantages.

Stripper 77 softens photo resist, including KMER, KPL, and KPR, until the bond is broken between the metal and the photo resist coating. The loosened resist then can be washed away with a pressure spray rinse. Coagulation problems normally caused by removed KPR dye are eliminated because the dye is dissolved in Stripper 77 and the solution remains clear. Stripper 77 is used at room temperature. Supplied as a concentrate, cost is as low as $2.75 per diluted gallon. The solution is not viscous. Consequently, drag-out is minimized and the solution rinses freely from printed circuit holes. Small additions of concentrate will replenish the solution for extended use. Shipley Co. Inc., Walnut St., Wellesley 81, Mass.

Print No. Ins. 107 on Reader Service Card

Quick-Disconnect Harness

Tube and wire diameters as small as 1/8" can be harnessed by new Flip-Loc clamps. A molded insert that insulates and cushions the tube or wire permits fast access by means of a hinge and quick detach key-nut fixture. Disassembly may be accomplished without removing the clamp from its mounting. The resilient insert provides a 360° grip and reportedly prevents any pinching or chafing of tube or wire. It is available in either neoprene or an aromatic, fuel-resistant material. Special insulating materials are available on special order. TA Manufacturing Corp., 4607 Alger St., Los Angeles 39.



Print No. Ins. 108 on Reader Service Card

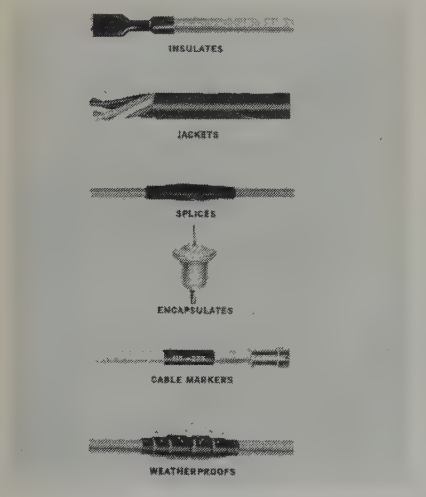
Protective Film for Electrical Equipment

Long lasting protection against moisture and oxygen is provided by new "Lectra-Shield" coating recommended for use on totally enclosed motors, insulators, electronic gear, and electrical equipment cabinets. Lectra-Shield reportedly forms a continuous protective film from 1 to 8 microns thick and makes treated surfaces highly water repellent. Its thin film engulfs industrial and coastal contaminents that lower the resistance values of electric gear. It can be applied over previous coatings without re-cleaning. Lectra-Shield is a non-conductor and will not arc. It may remain effective less than a year or more than five years depending upon the conditions pertaining to the application, but may be re-applied at intervals to maintain protection. Corrosion Reaction Consultants, 116 Chestnut St., Philadelphia 6, Pa.

Print No. Ins. 109 on Reader Service Card

Heat-Shrinkable Tubing for Insulating and Marking

Insulating and marking tubing that shrinks to form a tight mechanical bond within 7 seconds following application of heat (135°C) is called "Alphlex" shrinkable tubing. It is an irradiated, flame-retardant, thermally stable, modified polyolefin base product which may be slipped over wire and cables, hosing, terminals, or conduit. Longitudinal shrinkage is said to be less than 10%. Tubing is marketed in standard packages of 4′ lengths. It reportedly has excellent temperature characteristics and remains flexible and strong from —55°C to 135°C continuous. Within this temperature range it will not melt, harden, run, crack, or blister. Flexibility remains constant throughout the expansion and reduction process. High dielectric and mechanical



strength are also claimed. Other applications include use as insulation for cables, harnesses, pigtails, bus bars, and electronic components. Tubing also may be used to protect terminals, to insulate tool handles, and for permanent, easy-to-use cable markers and color coding. It is easily marked or stamped with hot stamping equipment. Long shelf-life and freedom from radioactivity after irradiation are other characteristics reported. Alpha Wire Corp., 200 Varick St., New York 14.

Print No. Ins. 110 on Reader Service Card

Flame-Retardant Epoxy Resin For Casting and Laminating

A new flame-retardant epoxy resin has been developed for hot-melt castings and dry lay-up laminating systems. Combined with aromatic amine or anhydride hardeners, the new epoxy, designated Bakelite ERL-0625, reportedly forms cured systems with excellent physical, electrical, and chemical resistance properties similar to those of conventional diglycidyl ether of bisphenol-A epoxies. Anhydride hardeners give the best high-temperature stability. The new resin passes the ASTM D-635, 30-second ignition flammability test. Semisolid at room temperature, the new resin requires only moderate heating to become a readily pourable liquid. It is usually warmed to about 130°F for casting systems, and to 150-155°F for laminating systems. For both casting and laminating, ERL-0625 is handled and cured in essentially the same way as corresponding diglycidyl ether of bisphenol-A systems. However, in most cases, ERL-0625 systems take somewhat longer to gel and develop lower exotherms than other epoxy systems. Union Carbide Plastics Co., Division of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 111 on Reader Service Card

High Flow Polypropylenes

Two new "Escon" polypropylene grades are designated 107 and 117. They are designed to give extra high flow, permitting maximum cycle retention by fast filling of even the most complex molds. Flow characteristics also are said to allow easier molding of thin-wall sections and to encourage the reduction of molded-in stresses. Both materials have a melt index of 12 @ 230°C, but differ in that 117 contains only additives approved by the FDA. Price is 42 cents/lb in 20,000-lb lots. Enjay Chemical Co., Room 1131, 15 West 51st St., New York 19.

Print No. Ins. 112 on Reader Service Card

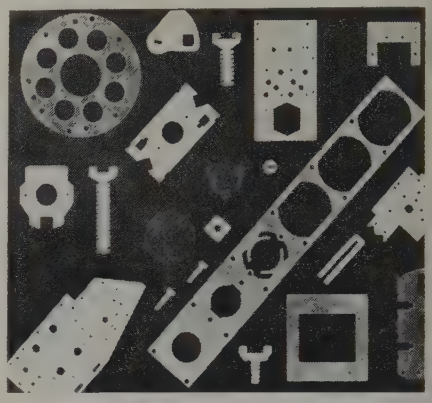
Smallest Epoxy Rods

Easy-to-machine epoxy rods are said to be available in the smallest sizes ever made, from 9/16″ diameter down to 3/16″ diameter. Rods reportedly meet the specifications and requirements of the resistor industry. They are stated to be non-melting, self-extinguishing, and distortion resistant under ultra high heat conditions. Specification sheets and samples available. Polytronics Co., Box 236, Dunellen, N. J.

Print No. Ins. 113 on Reader Service Card

Low Cost Glass/Polyester Laminate for Class B Uses

New fiber glass reinforced polyester laminates for class B electrical insulation are said to have outstanding retention of properties both during and after application of heat. Grade TSA flat sheet stock meets or



exceeds NEMA GPO-1 specifications. The 1/16″ and 3/32″ thicknesses cost 65¢/lb in quantities of 300 lbs or more. The 1/8″ through 5/8″ thicknesses cost 58¢/lb. Features claimed include excellent dimensional stability under exposure to heat and moisture, retention of 100% of impact strength after heat aging at 250°C, and perpendicular dielectric strength retention of 75% after 200 hrs at 150°C. Another feature cited is excellent punchability; the stock can be punched or sheared cold without delamination, cracking, or hole breakout. Among a variety of electrical insulating applications expected is use as wedges and top sticks in class B rotating apparatus. Data and samples available. The Glastic Corp., 4321 Glenridge Road, Cleveland 21, Ohio.

Print No. Ins. 114 on Reader Service Card

Dielectric/Thermal Insulating Sandwich Constructions

New molded sandwich constructions may be used in dielectric and/or thermal insulating applications from sub-zero temperatures to 2300°F. A member of the silica alumina family, "Insulmax" is said to be strongly interwoven in its molded form and capable of being molded into intricate shapes and configurations. Densities

Print Ins. 31 on Reader Service Card

Cables manufactured by Reynolds Metals Company, Richmond, Virginia. Covering extruded of Tenite Polyethylene.

Why Reynolds covers these aluminum conductors with TENITE POLYETHYLENE

To obtain the highest possible performance from their secondary distribution and service line cables, Reynolds Metals Company chooses Tenite Polyethylene as a covering material.

Tenite Polyethylene is manufactured under as rigid a system of quality control as Reynolds' own aluminum conductors, and makes a tough, weatherproof, fast-stripping covering material which offers high dielectric strength and resistance to abrasion, heat, moisture, chemical attack and stress cracking. It remains flexible even at sub-zero temperatures and its light weight permits easy handling and wide spans. Users report that it gives long service life without festooning or splitting.

Tenite Polyethylene is easily extruded as jacketing or insulation for many diverse applications, from coaxials to control cables, from TV lead-ins to telephone wires. For a material with outstanding electrical, physical and chemical properties, specify Tenite Polyethylene. For further information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers in a unique spherical pellet form which flows freely in the extrusion process and in "air veying" of bulk shipments from truck to bin.

TENITE®
POLYETHYLENE
an Eastman plastic

may be varied to suit physical and thermal requirements. Constructions may be custom designed and molded onto customer-furnished metal or ceramic structures. The sandwich structures may consist of metal skins on both sides of the integrally molded insulation, or a metal skin on one side and a heat resistant fiber glass lamination on the other. Thin, lightweight metal or ceramic parts reportedly may be used as cores without fear of distortions because of the low molding pressures used. Typical applications include nose cone internal insulation. Test panels to user specifications available. Olympic Plastics Co. Inc., 3471 S. La Cienega Blvd., Los Angeles 16.

Print No. Ins. 115 on Reader Service Card

High-Strength Rag Paper For Insulating Motors

A new, high-strength rag motor insulating paper features unusual ability to stretch before rupture. Made from selected new cotton cuttings, "Duro-X" reportedly has no added color, is neutral in pH, and is chemically and electrically clean. It has a glazed surface and is available in sheets or rolls 46″ wide, and in gauges from .007″ to .030″. Duro-X can be drawn, formed, shaped, embossed, and cuffed and is especially adaptable for use as electrical insulation in fractional and integral horsepower motors as well as in generators and welding equipment. The material is also available in fabricated parts. Rogers Corp., Rogers, Conn.

Print No. Ins. 116 on Reader Service Card

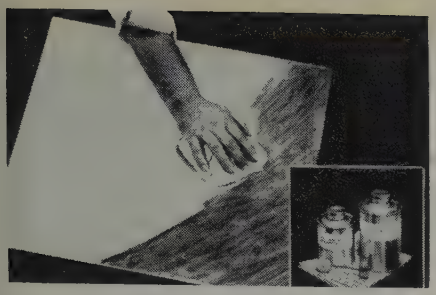
Colored Dry Spray for Mold Release And Lubricating Uses to 500°F

A dry mold release and lubricant of unusual properties that can be sprayed on parts and materials as an easily-identified color coating has been developed for a wide range of industrial uses in such areas as electronics, plastic fabricating, and rubber. S-122-C mold release-lubricant is based on a recently perfected fluorocarbon dispersion that is reported to perform effectively under conditions of high temperature (up to 500°F). It forms slick coatings that do not pick up dirt, run, stain, or dissolve in common solvents. The color-base material permits users to distinguish between coated and non-coated areas and helps improve application efficiency. It is said to be particularly advantageous as an inexpensive mold release for electronic potting and encapsulating, injection and compression molding of phenolic and epoxy resins and silicone rubber, and as a general mold release and lubricant for plastics and metal products. The agent acts as a water and oil repellent on a wide range of surfaces. Miller-Stephenson Chemical Co., 39 Day St., South Norwalk, Conn.

Print No. Ins. 117 on Reader Service Card

Test Kit Offered To Show Non-Porosity of 'Teflon' Sheet

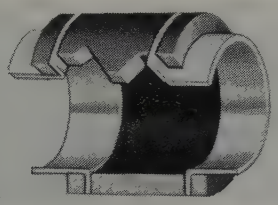
Free test kit which will show up porosity in improperly molded Teflon sheet is offered to substantiate claim that new molding techniques with specially designed equipment produce "Chemfluor" molded Teflon sheet up to 24″ x 24″ which is non-porous. This uniformly high density improves such properties as tensile strength, elongation, permeability, dielectric strength, and flex life. When a special red penetrant dye from the test kit is



applied to the surface of porous sheet the dye penetrates the microscopic voids, making the porous areas clearly visible. The test itself is said to be quick, simple, effective, and required by military specifications. Kit consists of a generous supply of penetrant and solvent, together with applicator and complete instructions. Write Chemplast Inc., 3 Central Ave., East Newark, N. J.

Alumina Ceramics for Metalization

High alumina ceramic parts and components are available in volume for production metalizing. Illustrated is a typical butt seal with alumina ceramic body and ceramic insulating rings top and bottom. Between these three components are sandwiched

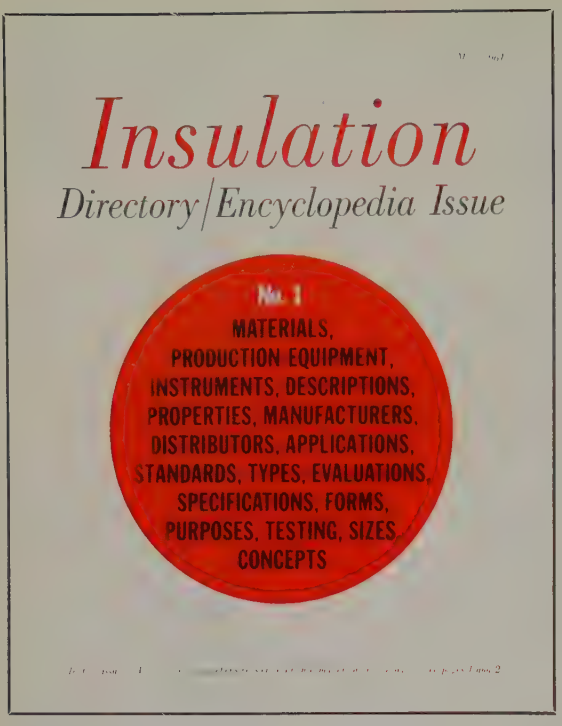


metal collar and rings to form a vacuum-tight assembly. Any metal may be used in the assembly. Metallizing may be performed using any suitable process by which the metal can be brazed. If desired, the metalized section can be plated prior and subsequent to the brazed assembly. The ceramics are specially formulated for electronic usage in vacuum tubes and semiconductor assemblies of all types. Spray drying of the ceramic bodies is used to avoid possible contamination and to control particle size. It is stated that surface texture and porosity are both under close control and that parts are finished to close dimensions. Bulletin available. Diamonite Products Mfg. Co., Dept. TC-5, Shreve, Ohio.

Print No. Ins. 118 on Reader Service Card

Pressure-Sensitive Silicone Rubber Tape for HV Splices and Terminations

A pressure-sensitive, unsupported



CONTENTS: Listing of Manufacturers, Converters, Fabricators, and Testing or Research Companies • Geographical Listing of Distributors and Agents • Tables and Formulas • Glossary • Insulation Standards, Concepts, and Applications • Gaseous Dielectrics • Liquid Dielectrics • Fibers, Cords, Twines, Lacing Tapes, and Untreated Felts, Mats, Woven Tapes, and Fabrics, Non-Adhesive • Treated and Untreated Papers and Boards • Treated and Untreated Vulcanized Fibre • Flexible Tubings, Sleevings, and Tubular Specialties • Flexible Coated or Treated Cloth, Felt, Mat, and Unidirectional Yarn Tapes and Sheeting (Not Self-Adhering) • Flexible Cloth, Film, Fiber, Mat, and Paper Composite Insulations • Pressure Sensitive, Adhesive, and Self-Adhering Tapes and Specialties • Plastic Resins, Molding and Extruding Compounds, Molded Products, Plasticizers, Fillers, Reinforcements, Additives, Etc. • Rubber and Elastomer Materials, Compounds, and Processed Shapes or Products • Solidifying Fluids, Pastes, and Powders for Coating, Impregnating, Embedding, Encapsulating, Potting, and Casting • Non-Supported Flexible Plastic and Rubber or Elastomer Films, Tapes, or Sheeting (Not Self-Adhering) • Reinforced and Laminated Plastic Sheets, Tubes and Rods, Copper Clad and Unclad, Plain and Composite • Mica Products • Ceramic and Glass Products • Printed and Molded Circuits • Magnet Wire • Wire, Cable, and Assemblies (except Magnet Wire) • Insulation Test and Measuring Instruments, Equipment, Methods, and Services • Production and Processing Equipment for the Conversion, Fabrication, or Use of Insulation • Miscellaneous Products

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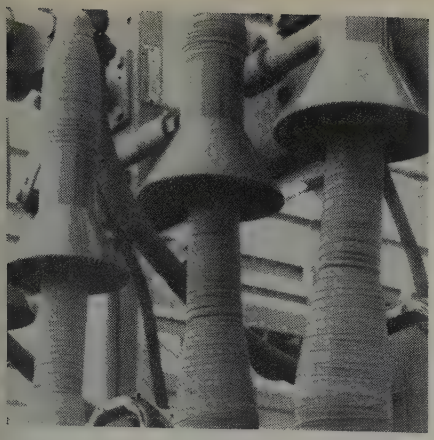


silicone rubber tape is said to combine the physical and electrical properties of silicones with ease of application to help solve high voltage splice and termination problems. Terminations in the primary substation at a salt mine, reinsulation of silicone rubber cable at a steel mill, and protection of primary bushings and potheads at a rayon mill are several of the situations where the tape is being used. Moisture and weathering resistance, ability to withstand temperature extremes and prolonged exposure to the effects of heat and cold. and resistance to ozone, corona, tracking, arcing, and chemicals are reported. "Scotch" brand electrical tape No. 70 is a cured silicone rubber with a pressure-sensitive silicone adhesive. The tape is designed to be compatible with silicone cable insulation and can be used as a protective cover on standard terminations and potheads. Designed to withstand temperature extremes of −85° to +392°F (−65°C to +200°C), and for continuous use at class H (180°C) temperatures, the tape will thermoset at elevated temperatures, giving a layer-to-layer bond double the strength of the original bond. No. 70 tape has a thickness of .015", tensile strength of 11 lbs/in, adhesion of 14 oz/in, electric strength of 10,500 v (700 vpm), and an insulation resistance of 1 x 10^6 megohms. Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 119 on Reader Service Card

Lower Cost Mica Punched Segments and Molded Rings

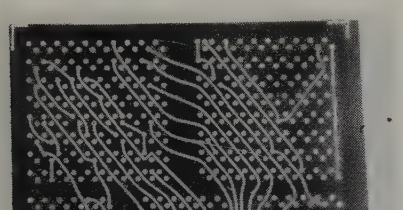
New Zeta-Mica punched segments and molded rings for commutators are made of special grade muscovite

(India) mica splittings bonded with natural or synthetic binders. Zeta-Mica segments and commutator rings are said to have the same high dielectric properties as other mica products but sell at a lower cost. Bulletin No. 4 available. The Macallen Co. Inc., Newmarket, N. H.

Print No. Ins. 120 on Reader Service Card

Multilayer Printed Circuitry

A new technique in multilayer printed circuitry designed for government use reportedly can provide space savings of 60%, making the method ideal for micromodular use or wherever circuit boards with wire harnessing must be compacted into a minimum of space with maximum reliability of interconnections. Crossover connections are internal and metallurgically bonded to each other. Circuits are placed one on top of the



other, with each layer just .006″ in thickness—six interconnecting layers can be compacted into a plane just .036″ thick. This makes possible a solid copper terminal .036″ deep, which acts as a rivet through the internal connecting layers and provides reliability and stability of contact. Each plane of the multilayer circuitry can be up to 13″ x 16″ size. Since the multilayer printed circuitry is rigid (circuit is supported by a substrate), it can act as a substrata for the assembly. Interconnecting conductive layers may be 1 oz or 2 oz copper with the top surface made of a precious metal for easier soldering and nondeterioration. Scientific Components Div., Intellux Inc., 30 S. Salsipuedes St., Santa Barbara, Calif.

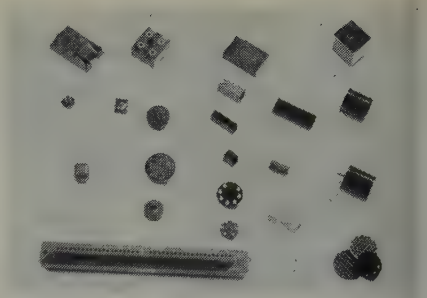
Print No. Ins. 121 on Reader Service Card

Semiconductive Polyethylenes for Cable Shielding and Jacketing

A new series of "Bakelite" semiconductive polyethylene compounds are designed for use as inner layers and/or outer jacketing on communications and power cables. The three new compounds are based on a polyethylene resin that permits the incorporation of large amounts of conductive materials while retaining most of the desirable properties of polyethylene. Each compound, in addition to offering various degrees of conductivity, exhibits distinct physical characteristics which make it suitable for certain types of applications. Most conductive of the three (less than 1½ ohm-cm volume resistivity) is Bakelite DFDA-0520. Designed only for internal use in cables, it is recommended as voltage stress relief shielding in high voltage cables. It also can replace copper braid as an electrical interference barrier or as a cable ground against lightning, the discharge being drained off before causing short circuits. For external cable jacketing, the new Bakelite DFDC-5275 (resistivity less than 10 ohm-cm) is recommended as lightning protection on multiconductor cables such as underground communications cables for missile sites. Properties claimed include excellent stress cracking resistance, low temperature impact, flexibility, and good elongation characteristics over a wide temperature range. The third new polyethylene, Bakelite DHDA-7800, possesses a combination of properties that recommend it for external jacketing where a moderate degree of conductivity is required. With volume resistivity less than 50 ohm-cm, it reportedly exhibits excellent stress cracking resistance and elongation, good impact strength, and low temperature properties. All three may be processed on standard wire and cable extrusion equipment. In truckload quantities, both DFDA-0520 and DFDC-5275 cost 65 cents/lb. DHDA-7800 is priced at 50 cents/lb. Union Carbide Plastics Co., Division of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 122 on Reader Service Card

Epoxy Molding Compounds for Use In High Temperatures, Humidity



Elements shown in illustration include encapsulating cups, encapsulated parts, and insulating connectors molded from "Epi-All," new epoxy molding compounds said to have unusual stability and reliability under conditions of high humidity and extreme temperatures. High arc resistance (to 180°), high dielectric strength, and excellent insulating properties are also reported. Molded parts are stated to retain these properties, together with dimensional stability and freedom from out-gassing, at temperatures as high as 500°F (260°C). The compounds are shelf stable for over four months, requiring no refrigeration to maintain moldability. Handling and molding ease is equal to, or better than, most other mineral-filled general purpose materials. Compounds are available in a wide variety of special formulations and colors. Mesa Plastics Co., 12270 Nebraska Ave., Los Angeles 25, Calif.

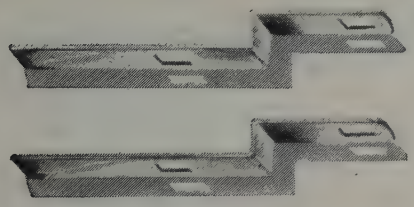
Print No. Ins. 123 on Reader Service Card

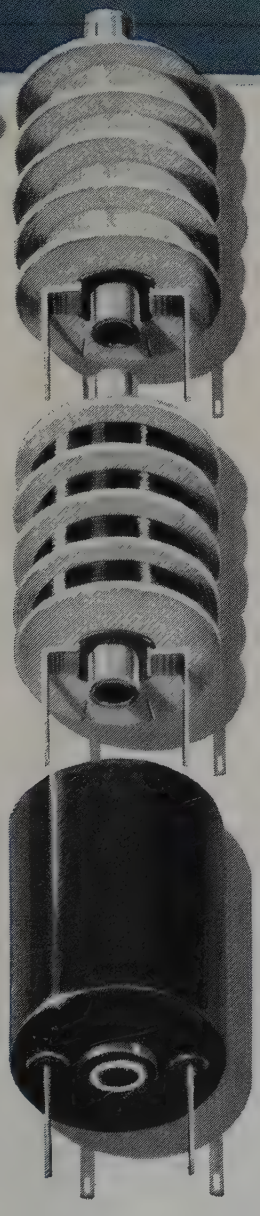
Tougher Polyethylene Insulation Does Not Soften at 300°C

A new conductor insulation material said to possess heat and abrasion resisting qualities hitherto unattainable is designated "Rome Poly-X." The material derives its properties from a unique polyethylene modifying process. Several times the abrasion resistance of conventional polyethylene is claimed. Recent tests reportedly show virtually unlimited resistance to environmental stress and thermal cracking conditions. Insulation rating values up to 600 v, a damage threshold temperature in excess of 300°C, and sufficient ductility to permit bending at temperatures as low as —55°C are reported. Poly-X exhibits thermosetting, rather than thermoplastic, behavior—a result of the modifying process which cross-links the polyethylene molecular chains. Service drop and overhead secondary conductors insulated with Poly-X are available. Availability on other products is anticipated in the

Plaskon®

ALKYD PERMITS MASS PRODUCTION OF INTRICATE RESISTOR





Encapsulation with putty-type Alkyd satisfies need for reliability by resistor maker and customers.

Today's creative engineers design with PLASKON Alkyd in mind for the manufacture of delicate electronic components. Here are reasons why electronic engineers prefer PLASKON putty-type Alkyds as *the* encapsulation medium:

- Simple to fabricate . . . molds quickly at extremely low pressures . . . permits rapid production cycles.
- Clean to handle . . . nothing to mix.
- Dimensional stability prevents distortion or damage to delicate inserts.
- Coefficient of linear thermal expansion is similar to that of popular wire alloys . . . reduces strain in service . . . aids the functioning of encapsulated units.
- Thermal conductivity helps to dissipate heat faster, resulting in less change in resistance value before and after encapsulation.
- Available in colors, for coding.
- More economical than most encapsulating processes.

Ultronix, Inc., San Mateo, Calif. manufacturer of quality electronic components, effectively utilizes PLASKON putty-type Alkyd in resistor production. The resistor pictured above in several stages of assembly includes an ingenious combination of three Alkyd parts—each one molded within the other—a most severe test of dimensional stability, moisture resistance, and consistency in performance. This resistor is built to meet or exceed all requirements of MIL-R-93B and MIL-R-9444.

PLASKON Alkyd Molding Compounds are outstanding for the qualities most necessary in molded parts for electronic and electrical applications. Competent Plaskon representatives will be glad to discuss material recommendations and fabricating techniques to fit your performance requirements. Telephone your local Plaskon representative or write to:

PLASTICS DIVISION
40 RECTOR STREET, NEW YORK 6, N. Y.

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near future. Rome Cable Div., Aluminum Co. of America, Pittsburgh, Pa.
Print No. Ins. 124 on Reader Service Card

Increased Life for Varnished Glass Cloth Upgraded to Class F

Upgrading of varnished glass cloth grade 5J04 to class F reportedly has increased its average life about five times at 158°C (100,000 hrs) and nearly three times at 230°C. The new insulating tape and fabric is recommended for applications where flexibility, good dielectric strength, and good mechanical properties are required. Its oil resistance is also said to be outstanding. Grade 5J04 varnished glass cloth is made of a straight-weave continuous filament of type D fiber in thickesses of .003", .005", .010", and .012". The varnish is a heat-reactive, tan, organic resin. The .010" fabric weighs approximately 0.71 lb/sq yd and has a tensile strength of 198 lbs/in width. Dielectric strength (vpm, short time method, ¼" diameter electrodes) will increase from 1940 as received to 2010 after 15 minutes in hot oil at 100°C. Standard tape widths and 36" wide rolls 36 yds long are supplied. Westinghouse Electric Corp., Micarta Div., Trafford, Pa.
Print No. Ins. 125 on Reader Service Card

High-Strength, Paper-Base Phenolic Rod

A new paper-base phenolic rod is stated to have exceptional physical strength and machinability. "Insurok" T-308R is further characterized by high density, low moisture absorption, and good electrical properties. Extensive field testing reportedly has shown T-308R to be particularly suitable for high speed machining. Typical end uses include pins, push rods for ignition systems of small horsepower engines, and inside threaded caps. Manufacturer claims that typical axial compressive strength exceeds

NEMA XXX standards by 30%, that flexural strength under condition A for ¼" rod tests at 25,000 psi versus the NEMA standard of 13,000, and that tensile strength is nearly double that listed as authorized engineering information by NEMA. Available in 42" lengths with diameters from 0.093" to 0.509" inclusive. Natural tan and black colors are available with standard and special finishes. The Richardson Co., Melrose Park, Ill.
Print No. Ins. 126 on Reader Service Card

Nylon/Epoxy Prepregs with High Physical and Chemical Properties

Two new nylon/epoxy prepregs with satin or straight weave feature high physical characteristics and resistance to chemicals. Weight of the satin weave prepreg is 0.81 lb/sq yd with monofilament nylon of 840 denier, 5 harness weave containing 40% B-stage epoxy resin. Resin content can be varied. Drape characteristics of the satin weave are advantageous in molding shapes and contours. Typical tensile test results at 71°C by the ASTM D-638 method reportedly show a modulus of 25,000, ultimate strength of 12,600 psi, and yield of 3400 psi for a random lay-up. The resin is said to have high flow characteristics, approximately 20% at 143°C, and a volatile content of less than 1.5%. The prepreg has tacky surfaces that adhere in laminating. The recommended curing cycle is 1-2 hrs at 150°C and 100 psi, followed by a post cure of 6 to 16 hrs at 150°C. Straight weave nylon epoxy prepreg has similar characteristics. Both straight and satin weave materials (TT-9565) are available in 37" width. off white in color. Westinghouse Electric Corp., Micarta Div., Trafford, Pa.
Print No. Ins. 127 on Reader Service Card

Finish Improves Heat Resistance Of Fiber Glass Fabric

A new finish which withstands extremely high temperatures over an extended period has been developed for application on fiber glass base fabrics. The I-540 finish—for use with high temperature phenolic resins—reportedly permits laminated fiber glass fabrics to withstand substantially higher temperatures over a greater length of time than heretofore possible. Its functional characteristics are said to make it particularly effective in high speed aircraft and missile applications. Test laminates of a 181-type fabric with 30% SC-1008 resin content and using the new finish show the following results: At 500°F for 100 hrs, flexural strength is 58,300 psi compared to 50,200 psi for similar type fabric with finishes heretofore in use. It is also stated that I-540 provides better flexural strength at lower temperatures and shorter exposure periods. Hess, Goldsmith & Co. Inc., Division of Burlington Industries, 1400 Broadway, N.Y. 18.
Print No. Ins. 128 on Reader Service Card

Urethane Foams with 20 Minute Pot Life

Rigid polyurethane foam materials in the density range from 2 lbs/ft^3 to 20 lbs/ft^3 are said to exhibit 20 minute pot life before foaming reaction occurs. The "delayed action" foams reportedly have low dielectric constant (1.25), low dissipation factors (<0.003), and good volume resistivities (10^{13}). The amount of heat liberated in reaction is stated to be 1/10th that generally encountered in commercially available foams. Brochure available. Rad Electronic Plastics Inc., 1466 Herkimer St., Brooklyn 33, N.Y.
Print No. Ins. 129 on Reader Service Card

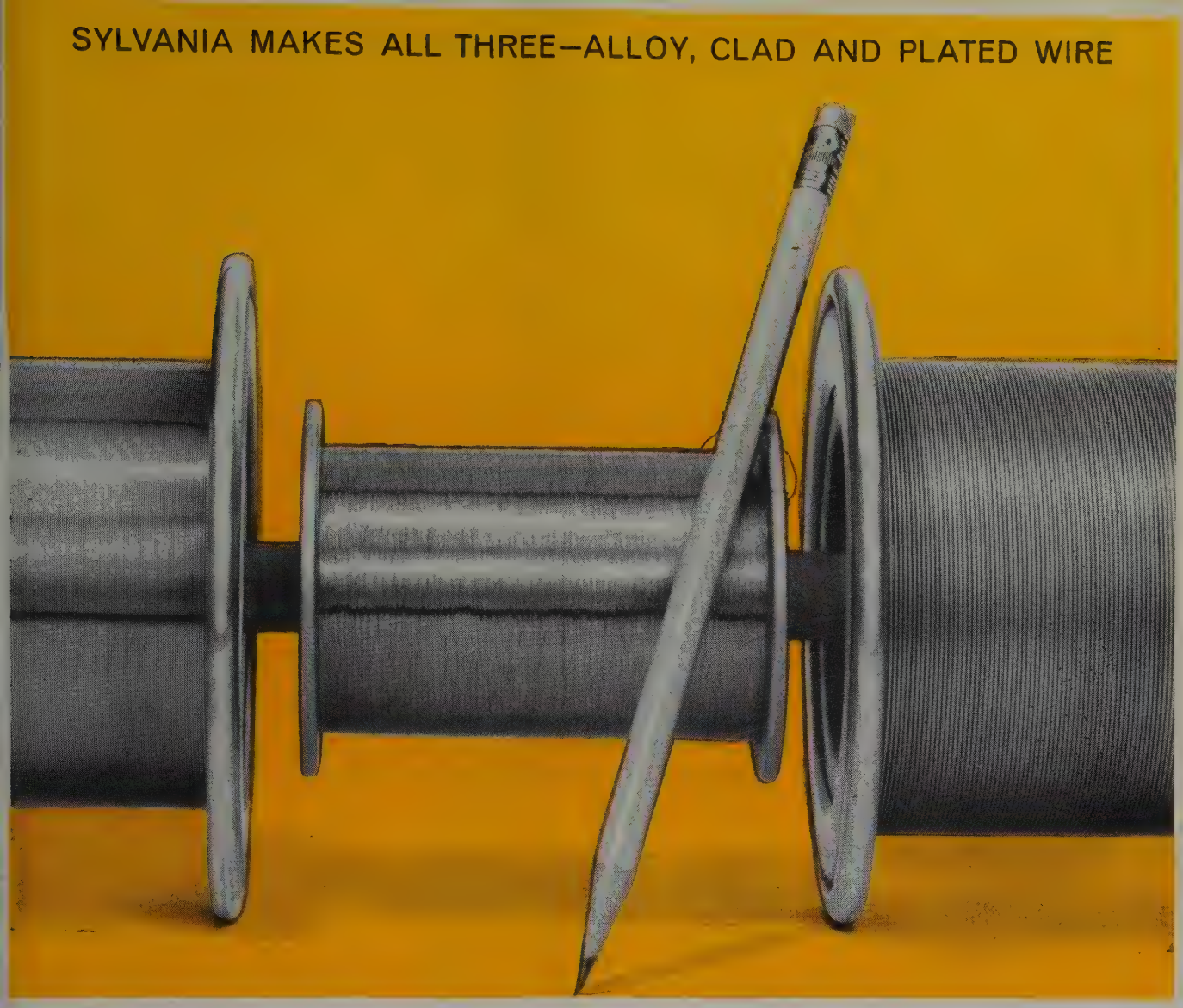
Irradiated Polyolefin Wire

A new irradiated polyolefin wire reportedly possesses radiation resistance and temperature and dielectric characteristics which are especially suitable for the environments encountered in satellite and ballistic missile programs. It is said to be 50% lighter than comparable plastic wire now being used and to cost substantially less. The wire also is stated to resist burning or shrinkback by soldering irons or soldering baths, making it highly applicable to commercial and military miniaturized electronic assemblies where soldering operations in manufacturing present problems. Radiation Materials Inc., Loral Electronics Corp., 825 Bronx River Rd., New York 72.
Print No. Ins. 130 on Reader Service Card

Flexible Ethylene Copolymer Molding Compound

Properties provided by a new ethyl-

SYLVANIA MAKES ALL THREE—ALLOY, CLAD AND PLATED WIRE



Where to start when you're writing specs

—Let Sylvania give you an unbiased recommendation on wire

When you're designing and specifying materials for special purpose applications, selection of the proper wire can be all-important. Clearly, there are wide variations in corrosion resistance, oxidation resistance, strength and conductivity.

That's why more and more engineers *start* with Sylvania when they specify wire. Of all major manufacturers, only Sylvania makes all three types of bare wire – alloy, clad and plated. Sylvania makes them in a full range of sizes, too—.002″ to .250″. Each and every one retains optimum characteristics up to recommended operating temperatures.

With such a complete line, you can be sure that a Sylvania recommendation is unbiased. It's based on *your* needs—*not* restricted by a limited line. Full details—for future use or help on a present project—are yours at Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania. Call or write.

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GENERAL SYSTEM

Print Ins. 37 on Reader Service Card

ene copolymer include excellent flexibility over a broad temperature range and high resistance to stress-cracking. The compound, which contains no plasticizer, is said to be easily injection molded, blow molded, and extruded in conventional equipment. Designated "Bakelite" DPDB-6169, at room temperature, it is reported to have the torsional stiffness of a 90A durometer elastomeric vinyl. Compared at —25°C, however, it is nine times as flexible.

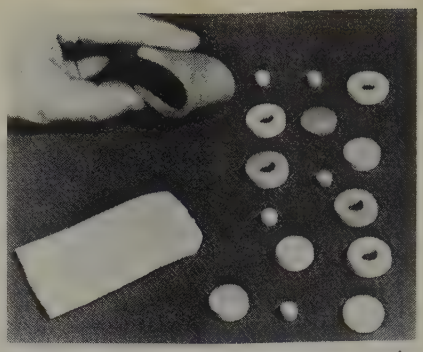
In flex cracking tests at 0°C the new material reportedly survives in excess of two million cycles. In stress-crack resistance it is claimed to be equivalent to vinyl and far superior to conventional polyethylene. Color potential is unlimited. Suggested applications include moldings and gasketings. Freedom from plasticizer or volatile ingredients, excellent heat stability, and competitive price are other advantages cited. Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.
Print No. Ins. 131 on Reader Service Card

Epoxy Rubber for Wire And Cable Splicings

Low viscosity liquid epoxy material, with either a room temperature or oven curing system, reportedly polymerizes to desired shore A durometers, exhibits excellent adhesion to all materials, and exceeds MIL Spec S-8516. This rubber-like material is used for enclosing wire cable splicings, which need an insulating, moisture, and shock-proofing package. The resin can be modified to be used for vibration-damping moldings of cast parts or as flexible adhesive in thin films. Brochure available. Rad Electronic Plastics Inc., 1466 Herkimer St., Brooklyn 33, N.Y.
Print No. Ins. 132 on Reader Service Card

High Heat Sponge Dielectric with Good Chemical Resistance

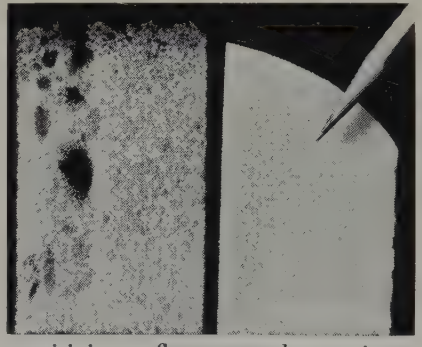
A new sponge dielectric material reportedly offers excellent resistance to chemicals, acids, and fuels. High dielectric strength and a broad temperature range are other features reported for the sponge which is molded from "Fluorel" 2141 elastomer. It is said to compare in hardness to a very soft rubber with about a 20 durometer (shore A) rating, yet to retain the inert characteristics of the base elastomer. The blown version has about a fourth the density of the solid material. Industrial Electronic Rubber Co., Solon, Ohio.



Print No. Ins. 133 on Reader Service Card

Silicone Additive for Rigid Polyurethane Foams

A new silicone additive is reported to facilitate production of improved polyurethane foams through excellent stability—in storage, in all systems, alone, or in a package premix; less sensitivity to flame retardants, viscosity, color stabilizers, and variations in mixing; and ease of handling and mixing. Named Dow Corning 113, the new additive is a silicone-glycol copolymer. Photo contrasts foams produced from package premixer subjected to identical long term standing. Uniform foam at right was made with premix containing Dow Corning 113. Liquid and highly compatible with all systems, the material is said to be easy to handle, measure, and mix; and to require no special techniques. It is used at concentrations from 0.3 to 0.8% based on total weight. Dow Corning Corp., Midland, Mich.



Print No. Ins. 134 on Reader Service Card

Epoxy Adhesive for 60-Second Room Temperature Cure

"Minit-Cure" epoxy adhesive reportedly will cure in 60 seconds at room temperature and can be accelerated to 45 seconds with use of infrared heat. The resin-hardener adhesive system is stated to be ideal for automatic meter-mixing-dispensing units in rapid production line work which may eliminate soldering operations. Expensive oven investments and heating costs are eliminated. Available in 8 oz trial kits at $6. Allaco Products, 238 Main St., Cambridge 42, Mass.
Print No. Ins. 135 on Reader Service Card

Spray-on Silicone Grease Protects Insulators, Components, and Assemblies

The insulating silicone-base grease called "Insulgrease," which is designed to alleviate effects of atmospheric contamination deposits on insulators, has been developed for use as a spray. Previously applied by hand methods using brushes and rags, the silicone coating can now be sprayed directly to insulators at any desired thickness simply by clamping specially-designed spray equipment to the Insulgrease containers. In addition to savings in application time and labor, direct spraying also is said to provide material savings since fogging and overspray into the atmosphere are eliminated. Where conditions warrant, Insulgrease can be dissolved in a vehicle and sprayed as a liquid known as "Insuljel" which can be supplied in aerosol cans for touchup or emergency use.

Insulgrease reportedly shows high stability characteristics not only over a wide thermal range, but also when exposed to ultraviolet rays and other atmospheric conditions. The silicone coating can also be used to inhibit oxidation of cable connectors, prevent moisture collection and dew formation in electronic devices, prevent adhesion of ice on disconnect switch contacts, and to prevent corrosion of battery terminals, cables, light bulb bases, switch mechanisms, etc. General Electric Co., Insulator Dept., Box 57, Baltimore 3, Md.
Print No. Ins. 136 on Reader Service Card

Release Agent Also Prevents Arcing and Short Circuits

A new release agent and dry lubricant, known as GS-3, has been developed for the plastics, electronics, and aircraft industries. It is useful in molding, casting, laminating, and

Print Ins. 38 on Reader Service Car

THIS remarkable plastic may trigger a new (or cost-saving) design idea for you

National Vulcanized Fibre is unique. It's a tough, cellulosic plastic—not mere paper or fiberboard. Vulcanized Fibre possesses an unusual combination of mechanical, electrical and thermal properties. For example . . .

It weighs one-half as much as aluminum, yet is one of the strongest materials known per unit of weight. It's tough, durable and cushions the shock of repeated blows.

Vulcanized Fibre has superior arc-resistance. It comes in standard and special grades, including a fire-resistant grade called "Pyronil." It can be machined, formed or deep-drawn into intricate shapes, and can be combined with other materials . . . aluminum, rubber, "Mylar," copper, laminated plastic, plywood, to name a few.

You can polish it, paint it, lacquer it, emboss it. And regardless of the finish, it resists oils, gasoline, fungi, most solvents. Most surprising is its low cost.

Find out for yourself why National Vulcanized Fibre is "the plastic with a million uses." There's a free sample kit waiting for you at a nearby NVF sales office. Check Sweet's Product Design File 2b/Na for the one nearest you. Or write directly to Dept. R Wilmington, Delaware.

116 Choices: One Source This is the latest count of the different plastics and grades NVF can offer in your search for the *one best material.* Add to this total *the* one special grade that can be developed from scratch to meet your particular need. This full range of materials is backed by complete engineering services . . . from application assistance up to and including the delivery of 100% usable, precision-fabricated parts . . . in any quantity, on time!

Call the NVF Sales Office near you. It's a direct line to single-source help on your current materials problem.

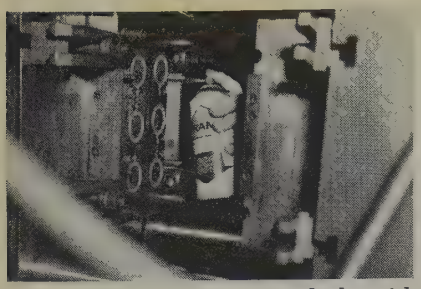
NVF

NATIONAL VULCANIZED FIBRE COMPANY
WILMINGTON 99, DELAWARE
In Canada: NATIONAL FIBRE COMPANY OF CANADA, LTD., Toronto 3, Ontario

5 grades of polyester

85 Phenolite® laminates

3 thermoplastics . . . nylon, Delrin®, Penton®



foaming operations, particularly with plastics and thermoplastics. It reportedly releases perfectly, is clean, dry, non-oily, colorless, non-staining, dripless, dries almost instantly without the application of heat, and does not build up in the mold. Unaffected by oils, water, and most chemicals, GS-3 also is stated to prevent arcing and short circuits in electrical systems. It can be brushed, dipped, sprayed, or wiped. Ram Chemicals Inc., Gardena, Calif.

Print No. Ins. 137 on Reader Service Card

Alumina for High Power, High Frequency Vacuum Tubes

A new high alumina body is especially designed for use in high power, high frequency vacuum tubes. New material, designated as Body 207, is said to be extremely well suited to vacuum-type applications because of the ease with which it can be degassed. It has the high mechanical strength and high dielectric constant that is characteristic of high alumina materials. Standard samples available. Write to Centralab, The Electronics Division of Globe-Union, Inc., 900 East Keefe Ave., Milwaukee 1, Wis.

Conductive Liquid Vinyl for Shielding

New type of conductive liquid vinyl, called "Vyna-Shield," is stated to have instant adhesion to vinyl plastic and can be applied by dipping or brushing. It is expected to have many applications in the electrical and electronics field wherever light weight, low costing shielding of vinyl wire is required. Spectra-Strip Wire & Cable Corp., P.O. Box 415, Garden Grove, Calif.

Print No. Ins. 138 on Reader Service Card

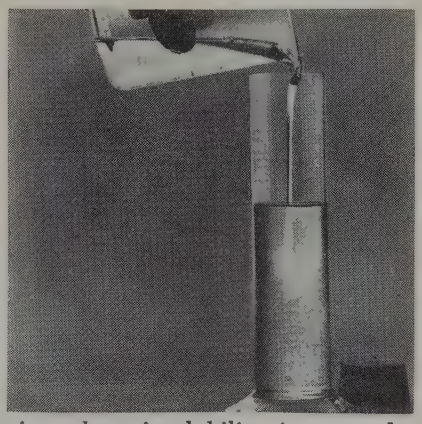
Solder Glass for Electron Tubes and Parts

A new solder glass is reported to seal materials in the Kovar expansion range. The devitrifying glass is said to have an effective setting point of about 420°C and a sealing range of 600 to 620°C. It is expected to be used to seal materials that do not usually seal to each other, such as Kovar and an aluminosilicate glass, widely used for high temperature electron tubes and parts. Corning Glass Works, Corning, N.Y.

Print No. Ins. 139 on Reader Service Card

Solvent Resistant Silicone Fluids

A new class of nitrile-containing silicone fluids has such properties as solvent resistance, limited electrical conductivity, and high dielectric constant. The N.S. (nitrile silicone) fluids are similar to dimethyl silicone fluids in that they have low surface tension. Suggested uses are as non-aqueous antifoams, base stocks for solvent resistant greases and coatings, antistatic agents, and as plasticizers and additives for plastics. The dielectric constants of N.S. fluids can range from approximately 3-20 at 60 cycles. The high polarity of the nitrile group



gives them insolubility in non-polar solvents such as aliphatic and aromatic hydrocarbons. These fluids are soluble in certain polar solvents such as alcohols, ketones, and ethers. This type of solubility makes them valuable where oil and solvent resistant fluids or coatings (such as lubricants or greases) are desired. Varying degrees of insolubility in non-polar solvents are possible, depending on the nitrile content of the grade of N.S. fluid selected. Other characteristics noted include hydrolytic and thermal stability and relatively low toxicity. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 140 on Reader Service Card

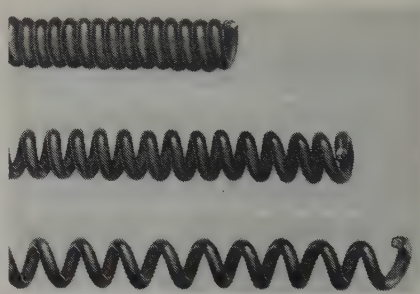
Custom Color System For Polypropylene

Color-Pak, a custom-matched concentrate system for "Escon" polypropylene, is said to be designed for use by molders who desire end-product custom color matches at a minimum cost. In addition, the new coloring method eliminates dusting during mixing. The masterbatch color concentrates are blended with natural Escon before use in the ratio of 1:10. Most present Escon grades are adaptable to the system. Enjay Chemical Co., Room 1122, 15 West 51st St., New York 19.

Print No. Ins. 141 on Reader Service Card

Retractile Coil Cords

A complete line of neoprene jacketed, retractile coil cords—electric cords that are permanently coiled into a spring shape—are said to offer an extra degree of safety in many electrical applications, to minimize the dangers of entangling and twisting line cords, to present a neat appearance, to save space, and to be easy to use. The specially designed neoprene jackets reportedly are designed to withstand constant heavy duty use, to prolong useful life, and to resist oil and weather damage. The cords maintain a compact spring-like shape until used—then extend only to the exact length wanted. In the manufacturing



process, the coil is rewound after vulcanization, reversing the direction of the spiral to insure maximum retractibility after repeated usage. The cords are available from stock as power cords, power cord sets, shielded communication cord, communication coil cords, and retractile test lead wire. Alpha Wire Corp., 200 Varick St., New York City.

Print No. Ins. 142 on Reader Service Card

High Temperature Terminal Bushings

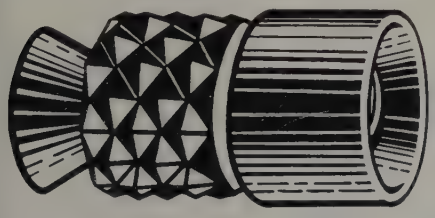
Three series of fluted terminal bushings and four series of tubular terminal bushings are designed for use where silver solder, brazing, or weld-

ing of terminal assembly to container is made necessary by higher operating temperatures than can be withstood by soft solder seals. They are said to be ideal for use by manufacturers of transformers, capacitors, filters, networks, and other large hermetically sealed units. The insulator bodies are made of 94% alumina, glazed on external surfaces. All metallized areas are prepared by application of a patented high-temperature metallized coating. The metal hardware consists of nickel iron flanges and caps with fused silver finish. Terminal studs or lugs of cold rolled steel are nickel plated. Assembly of metallized ceramic with hardware is accomplished by means of pure silver braze. Literature available. Frenchtown Porcelain Co., Frenchtown, N.J.

Print No. Ins. 143 on Reader Service Card

Threaded Miniature Insert for Plastic Electronic Components

A line of expansion inserts which provide durable brass threads in molded plastic now includes miniature inserts for screw sizes 0-80 through 3-48. The "Dodge" cone-spread insert

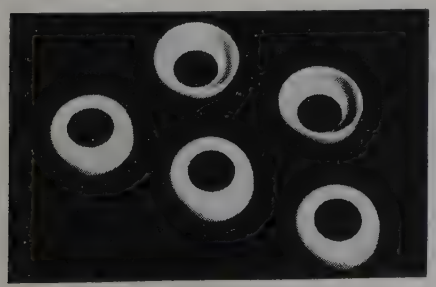


is said to be especially suited for molded plastic parts requiring miniature size threads. Examples are instrument cases and components, switch components, and many other miniaturized electronic parts. Bulletin P-106 available. Phelps Manufacturing Div., Heli-Coil Corp., Danbury, Conn.

Print No. Ins. 144 on Reader Service Card

'Teflon' End Caps for Capacitors and Other Electronic Assemblies

A variety of sizes and styles of Teflon end-caps may be used in ca-



pacitors as well as in other precision electronic components. The end caps for electronic assemblies are made from 100% virgin TFE-Teflon and reportedly provide outstanding electrical, thermal, chemical, and sealing characteristics. Tri-Point Industries Inc., Albertson, Long Island, N.Y.

Print No. Ins. 145 on Reader Service Card

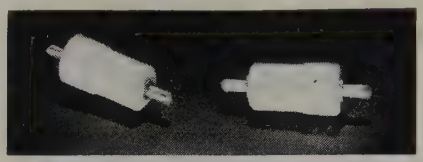
Large Terminals and Connectors

New large size solderless electrical terminals and connectors cover the larger wire sizes through No. 2 awg. Line includes over 100 parts. Elongated ring terminals for tight clearances are featured, as well as regular ring terminals, butt and parallel connectors. All are made in wire ranges of No. 8 (.050″ stock), No. 6 (.057″ stock), No. 4 (.075″ stock), and No. 2 (.075″ stock). Stud sizes from No. 6 through ¾″ are covered. A wide variety of standard insulated and non-insulated solderless terminals and connectors may also be provided. Samples, prices, and literature are available. ETC Inc., 990 East 67th St., Cleveland 3, Ohio.

Print No. Ins. 146 on Reader Service Card

Miniature Double Standoffs for Wiring Both Sides of Chassis

Type DST-900 Press-Fit double standoff terminal provides means of wiring both above and below the chassis with complete electrical isolation via a single terminal installation.

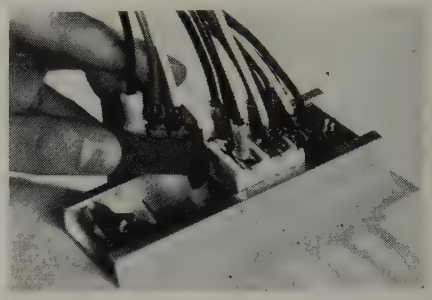


A straight shank lug protrudes from both ends. Internally, the two lugs are suitably separated by solid "Teflon" to provide electrical insulation. Sealectro Corp., 610 Fayette Ave., Mamaronek, N.Y.

Print No. Ins. 147 on Reader Service Card

Modular Terminal Panel Wiring Block

A new modular terminal block for use in all electrical control distribution and power control circuiting applications reportedly provides high density potential, does not require tools for the insertion and removal of the multicircuit wires, and allows



many variations of stack configurations. Bases for the product, brand-named "Termi-Blok," are modular 3-circuit common and 6-circuit common insulated cage assemblies which fit into an extruded aluminum track. The cages are made of tinplated brass, and are housed in nylon insulators. Within each of the modular cage assemblies there is a slotted stainless steel spring member, either 3-circuit

common or 6-circuit common. These commoned spring members accept tab terminals which are terminated to circuit wires by a compression crimp (accomplished with a contact-mated tool, either hand or automatic). Amp Inc., Eisenhower Blvd., Harrisburg, Pa.

Print No. Ins. 148 on Reader Service Card

Antennas for Detecting Micropulsations

Special-purpose antennas for investigating micropulsations in the earth's magnetic field have been designed and constructed by the National Bureau of Standards. These loop antennas, each 6½ feet in diameter and containing 32,000 turns of nylon-coated copper wire, will be used to collect data on the behavior of micropulsations and to discover how they can be related to unusual manifestations of solar or magnetic activity. Results of this program, only recently begun, are expected to provide further useful information about ionospheric disturbances arising from extraterrestrial sources which may affect radio communications.

On the rim of each loop antenna, in four separate channels, is wound 130 miles of copper wire. The wire is covered by a layer of copper screening, and finally the whole antenna is coated with fiber glass for protection and waterproofing. This protection is necessary because the antennas will be buried in the earth to prevent interference from wind action. They will be used to study oscillations in the broad range of periods from 200 sec. to 0.1 sec. which can be observed on a world-wide basis.

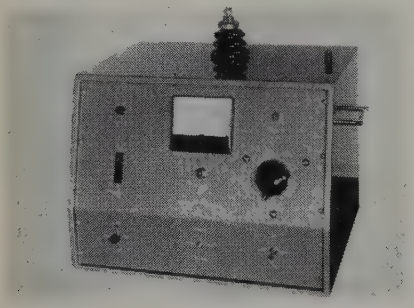
The antennas will also be of value in the study of two other types of electromagnetic waves—extra low-frequency sferics, which originate from lightning discharges, and one-to-three-minute giant pulsations which are thought to be caused by the resonance of the outer atmosphere when bombarded by charged particles from the sun.

New Instruments and Equipment

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card—no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

30 KV Breakdown Tester for Aircraft Ignition Insulation

A new high voltage (30 kv, a-c) test set, the model 4300 Hypot, has been designed for testing insulation of ignition harnesses of jet engines. Set provides an output adjustable from 0 to 30 kv, a-c, at 1 kva rating. Model 4300 is recommended for test-

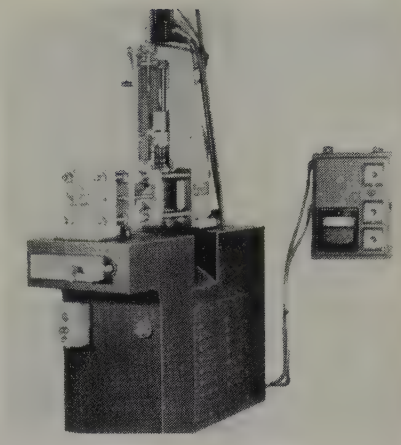


ing the ignition harness of the JT3-D-1 jet engine, and is suitable for similar tests on other aircraft ignition systems. Test sets are available with outputs up to 250 kv for measuring dielectric strength and insulation resistance of components and cables employed in aircraft ignition, control, and communications systems. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 201 on Reader Service Card

Low Cost Automatic Injection Molder

The "Auto-Hornet" Mini-jector, a fully automatic, low cost plastic injection molding machine is capable of producing items up to 1½ ounces of vinyl. The hydraulically operated unit has a horizontal clamping pressure of approximately 18 tons. Maximum timer cycles (dry) are 500/hr and the maximum casting area is 9 sq in. Standard equipment includes converging bore injection assembly with pyrometer control of the three cylinder heaters. The rear plunger



sleeve can be interchanged in various sizes, 1-1/16″, ⅞″, ¾″, and ⅝″, so the psi on the material can be increased by reducing the bore size. Ram and bore can be changed easily. Price is $3,600. Newbury Industries Inc., Newbury, Ohio.

Print No. Ins. 202 on Reader Service Card

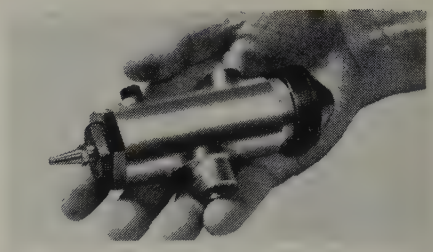
Two-Sided Circuit Printer

A new enclosed bench model unit designed to "shoot" both sides of a printed circuit in 1½ to 2 minutes uses cold cathode lighting which is said to eliminate fumes or harm to the eyes and to make it unnecessary to replace bulbs, tubes, or carbons. Model VF-MMB2 printer provides a 21″ x 24″ work area, and includes rotary lubricated vacuum pump, vacuum gauge, and relief valve. Lights are turned off automatically by the circuit timer. Work may be observed while it is under the vacuum by lifting the cover before the timer is set to start the lights. If the operator is called away during exposure, he is assured of a correctly-exposed plate and also against needless running of the vacuum pump after the lights are off. The VF-MMB2 printer is made of sheet steel, finished in hammertone gray, and measures approximately 24″ x 28″ x 16″ high. It plugs into any 115-v, a-c circuit. Millington Machine Co., 7428 S. Hoover, Los Angeles 44.

Print No. Ins. 203 on Reader Service Card

Automatic Gun for Dripless Small Shots of Flowable Plastics

An accurate, automatic-measuring



flow gun is designed for production speed application of measured quantities of any flowable material. The new midget-sized gun (model AMV-482) is easy to mount and connect into any regular production operation. The metering piston is actuated by material pressures from 50 to 2500 psi (determined by material viscosity). A specially developed, ground and honed valve automatically cycles the gun, which dispenses accurately measured shots of material with exact placement. Any excess of material is drawn back into the gun at the end of each delivery. It can be used singly or in multiple banks to apply plastics or adhesives in production, or for accurate, high speed filling of cavities or small containers. Shots are adjustable from 0 to 4cc. Cycling frequency and shot size may be adjusted without work stoppage. Pyles Industries Inc., 20855 Telegraph Rd., Detroit 41.

Print No. Ins. 204 on Reader Service Card

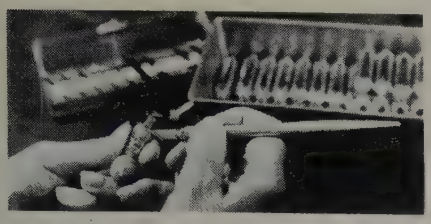
Automatic Circuit Tester Accessory

The LA-312 Impedance Module, an accessory to the LA-303 Robotester automatic tape-programmed circuit tester, is designed to extend Robotester capabilities to include precise measurement of capacitance, inductance, and complex impedance. It provides impedance measurement at 159.2, 1592, and 15,920 cps. The three frequencies are programmed in a manner similar to other functions of the Robotester, utilizing random selection techniques through punched tape. The frequency which is applicable to the circuit being tested is selected at the discretion of the programmer. Price of the LA-312 is $2950. Lavoie Laboratories Inc., Morganville, N.J.

Print No. Ins. 205 on Reader Service Card

Knife Set for Printed Circuit Repair, Other Electronic Jobs

The #E8 precision knife set consists of one aluminum handle with eight different interchangeable cutting type blades and a scriber blade packaged in a plastic snap-lid box. Illustration shows the knife being



used to shave solder off an electronic filter. The set is said to be ideal for printed circuit repair work. Replacement blades are available individually. R. N. Hunter Sales Co., 9851 Alburtus Ave., Sante Fe Springs, Calif.

Print No. Ins. 206 on Reader Service Card

Machine for Automatic Cutting Of Wire and Insulating Sleeving

For use in the electrical. electronics. and plastics industries, the Richmond automatic sleeve cutting machine is reported to produce up to 200,000 lengths of ¼" and up to 50,000 1" lengths per hour. At the end of the run, an automatic cut-out switches off the machine. A gripping device feeds the material automatically into

the cutting chamber. Blades set at specific intervals on a rotating drum cut the incoming material to the desired lengths; drums are interchanged for the length required. Standard models can cut lengths from

1/16″ up to 10″, in diameters ranging from .001″ to ½″. These cuttings are said to be accurate within a tolerance of ±.005″. Type 1A (⅛ hp) and Type 1B (⅓ hp) with fan-cooled electric motors are mounted in durable cabinets containing a receptacle for finished cuttings and storage space for the cutting drums. Type 2, designed for bench mounting, consists of cutting unit and motor. All of these models are standard. A scaled up version, Type 3, specifically built for the plastics industry, cuts lengths from 1″ to 36″, in diameters of 1″ or more. Size is 1′6″ deep, 2′ wide, and 4′6″ high. Machine can be used for a wide range of materials including paper, plastics, rubber, fiber glass, and tinned copper wire. Martin Engineering Co., 40 Woodbine Lane, Holyoke, Mass.

Print No. Ins. 207 on Reader Service Card

Miniaturized Wire Stripping

New machinery is said to permit custom wire stripping of any stranded or solid wire as fine as AWG #36. Most types of extruded insulation, including "Teflon," can be stripped with 1/16″ minimum each end, leaving as little as ½″ insulation length.

These short jumper wires reportedly have a tolerance of ±1/64″ for stripping and overall length, and are free of nicks and frayed ends. Manger Electric Co. Inc., Miller St., Stamford, Conn.

Print No. Ins. 208 on Reader Service Card

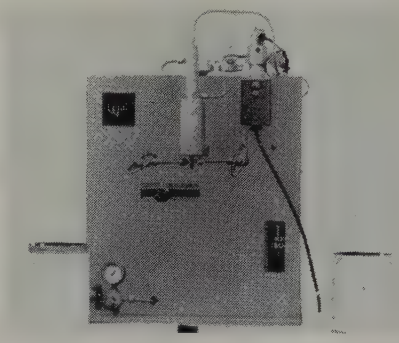
Altitude and Temperature Test Chamber for Bench Installation

A custom-built altitude and temperature test chamber features construction with the refrigeration and compressor units on top of the chamber to permit the unit to be mounted on a work bench. Unit will reach an altitude of 90,000 ft, with a rate of climb of 5,000 ft/min. Temperature drops to −100°F in 55 minutes, and rises to +250°F in 30 minutes. Other features include a 5″ thick glass window set in an aluminum door, 8″ thick insulation throughout, stainless steel interior chamber, provision for 14 electrical inputs, and six ¼″ AN fittings for both hydraulic and pneumatic input and output. Aerotest Laboratories Inc., Product Engineering Div., Comac Road, Deer Park, L. I., N. Y.

Print No. Ins. 209 on Reader Service Card

Plastic Dispensing Machine for Casting, Potting, Encapsulating

A new machine can be used to cast plastics based on reactive resins such as epoxy resins, polyester resins, polyurethane foams, and others which set by the admixture of two or more components. The unit is designed for electrical/electronic potting, casting,

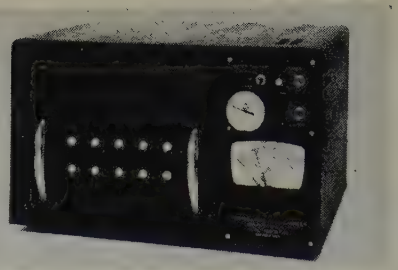


and encapsulating uses. Mixing head makes possible pushbutton molding of reactive resin materials and employs automixing principles that reportedly assure intensive mixing. The Mark 11/25 is a plunger piston pump unit where the two plunger pumps are driven by an air motor simultaneously at the required rates to deliver the proper proportions of resin and hardener to the head where it is mixed and dispensed. It is said to dispense up to 25cc of resin per shot at any required ratio from 1:1 to 1:25 with an error in ratio of less than 0.1% and at pressures up to 5000 psig. The liquid viscosity range that can be handled is from 10 to 50,000 centipoises, and with appropriate auxiliary equipment any flowable fluids can be used. Because of the unique and simple design of the head, shut down and intermittent use reportedly do not present problems and purging of the equipment is eliminated. The Leal Corp., P. O. Box 53, Oaklyn 6, N. J.

Print No. Ins. 210 on Reader Service Card

Rapid Temperature Cycling Chamber

A new temperature chamber, the

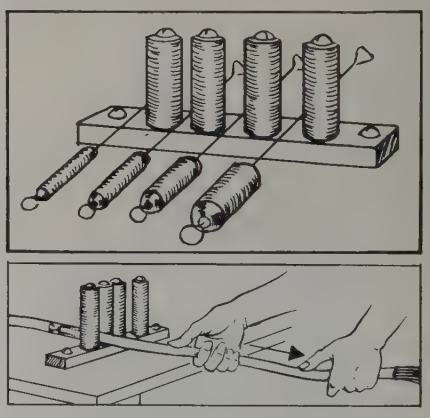


1060F portable table top model, is stated to be capable of completing a cycle between −100°F and +500°F in less than 12 minutes. Control accuracy claimed is ±½°F. Test volume is 10″×7″×7″. It can be cycled at shocking rates between preset temperatures by use of the MR-1 timer. At −65°F, consumption of liquid CO_2 is reported as less than 3½ lbs per hour. The unit weighs 40 lbs. Delta Design Inc., 3163 Adams Ave., San Diego 16, Calif.

Print No. Ins. 211 on Reader Service Card

Cable Sleever Helps Thread Wiring Through Plastic Sleeving

A new device to thread wiring harness through plastic sleeving, the "Little Joe" cable sleever, reportedly can be handled by one operator with considerable time-saving. The device will accommodate sleeving sizes from ¼″ up to 2″ OD. Up to 150 ft of harness can be covered in 10 minutes.

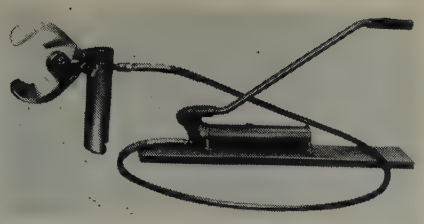


Equipment consists of two parts: 1) A set of four guide bullets of different sizes each of which is attached to a puller wire which can be attached to the cable end; and 2) a roller stand (consisting of four rollers). Price of complete cable sleeving equipment is $14.50 FOB plant. Macdonald & Co., 714 East California St., Glendale 7, Calif.

Print No. Ins. 212 on Reader Service Card

Hand Hydraulic Cable Cutter

New hand-hydraulic cable cutter is

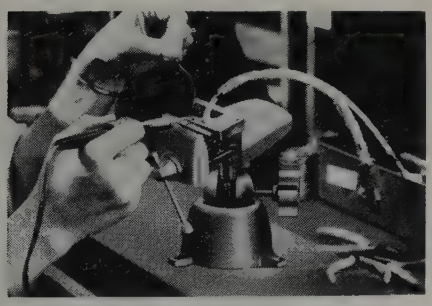


designed to cut copper and aluminum communication cable (not ACSR) up to 3″ in diameter. Cutter features a remote-control pump and a compact cutterhead. Illustrated model 179089 has a 3″ capacity (Model 179087 is similar but with 2″ capacity). These cutters are completely independent of any outside power source and can be taken right to the job—in the plant, underground, or anywhere in the field. H. K. Porter Inc., Somerville 43, Mass.

Print No. Ins. 213 on Reader Service Card

Work Positioners for Holding Circuit Boards, Other Parts

Work positioners hold all sizes and shapes of small parts. By tightening the one control knob on the side of the positioner, the head of the positioner can be turned to any desired angle and set firmly. Nylon jaws are available to protect delicate parts. Also available in the line is a circuit



board holder for holding all types of printed circuit boards. Size of the work positioner illustrated is 6½″ high and 5½″ wide. Jaws will open to receive up to a 2¼″ part. Hunter Tools, 9851 Alburtus Ave., Santa Fe Springs, Calif.

Print No. Ins. 214 on Reader Service Card

Tools for Cutting Glass Reinforced Plastic and Other Insulation

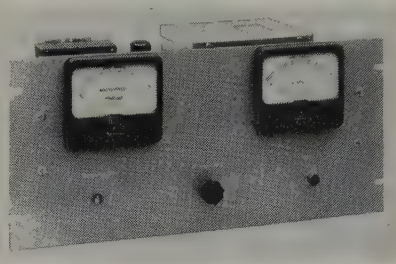
A new line of diamond coated tools for cutting glass reinforced plastic and other insulation materials, known as the "Standard" line, is designed for short runs or thin materials which do not require the long life of the regular line of "Heavy Duty" tools.

The new line will be priced approximately 25% lower than the Heavy Duty line. Catalog and price list available. Diachrome Inc., 612 W. Elk Ave., Glendale 4, Calif.

Print No. Ins. 215 on Reader Service Card

Power Supply

New RF type d-c power supply model Lab-10 is continuously variable from 0-15 kv with regulations across entire range better than 1% and d-c current output 2 ma. Available in either positive polarity output or

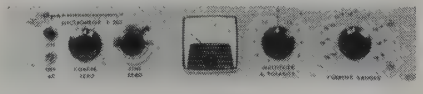


negative. Mounted on a standard 8¾" rack panel, complete with high voltage and current meters. Automatic overload and sensitivity control available at $50 additional. Price is $275 net. Spellman High Voltage Co. Inc., 1930 Adee Ave., Bronx 69, N.Y.

Print No. Ins. 216 on Reader Service Card

Electrometer

Electrometer with fast response time incorporates circuitry improvements which allow the technician or scientist to switch from event to event without affecting the electrometer's output function, yet the compact overall rack height of 3½" is maintained. Among the features are: coarse and fine zero adjustment, posi-



tive/negative multiplier switch which operates independently of the range switch, improved stability through an electronically regulated power supply of .01%, improved response time—ten times faster than previous models, outputs of 1-50 MV available, and accuracy of 2%. Price is $495 FOB plant. Gyra Electronics Corp., Washington & Elm Sts., P.O. Box 184, La Grange, Ill.

Print No. Ins. 217 on Reader Service Card

Unit Evaluates Porosity

Quick, easy, and accurate pore structure evaluations, increasingly important in the fields of plastics, ceramics, and other materials, are said to be readily obtained using the Aminco-Winslow porosimeter. Based on the mercury-intrusion principle whereby samples (either solid or powdered) are immersed in mercury and subjected to varying degrees of pressure (amount of mercury forced into the pores of the material under test is measured at specific pressure intervals), the porosimeter permits plotting pressure and volumetric readings on semi-log graph paper from which pore diameter and penetration data can be directly extracted. Two models are available; one rated at 5,000 psi and pore diameter size to .035 microns, the other rated at 15,000 psi and pore diameter size to .012 microns. Bulletin 2330 available. American Instrument Co. Inc., 8030 Georgia Ave., Silver Spring, Md.

Print No. Ins. 218 on Reader Service Card

High Power RF Calorimeter

Accuracy of a new self-contained and portable liquid calorimeter with average power capacity of 30 kw is conservatively stated as better than 5%. Distilled water system is sealed

and comes in contact only with stainless steel or inert materials. Power is read directly by means of a calibrated bridge circuit. Unit is supplied only with matched loads. Hektor Scientific Co. Inc., Norwood Municipal Airport, Norwood, Mass.

Print No. Ins. 219 on Reader Service Card

A diplomat is someone who can tell you where to go so tactfully that you look forward to the trip.

The Advertiser's Digest

Unbolted Breakers Interrupt 40,000-Amp Fault in 2 Cycles

A 138 kv air-blast breaker rested un-bolted on a flat bed truck while interrupting a 40,000-ampere fault in less than two cycles at recent American Electric Power System Corp. field tests.

According to engineers conducting these tests, a comparable oil circuit breaker under the same test conditions would require a heavy foundation and tie-down bolts to restrain the breaker during the resulting impact.

Included in the tests were single-phase, line-to-ground faults at three and at three-quarters of a mile down the line from the breaker. These "short-line faults" produce electromagnetic waves traveling back and forth on the line with the speed of light and result in the high rates-of-rise of recovery across the breaker.

To produce the highest rate-of-rise of recovery voltage possible, AEP engineers faulted the particular conductor having the highest surge impedance. The other two poles were blocked open to further increase the surge impedance and severity of the test.

The General Electric type ATB air-blast breakers reportedly cleared all faults in less than two cycles, and recorded a maximum interrupting time of only 1.85 cycles for all tests. The fault currents interrupted were said to be the highest ever recorded on 138 kv field tests.

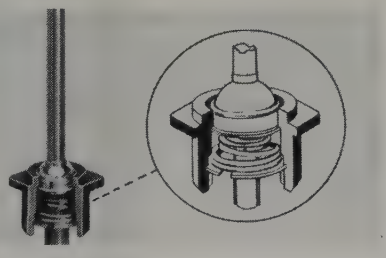
Power interruption tests with fault currents ranging from 8,200 through 41,000 amperes, including an ungrounded 3-phase fault directly on the bus, were conducted to prove the speed and reliability of the equipment.

Engineers inspecting the breaker after completion of the tests said the series could be repeated without renewal of parts.

Molded Plastic Housing Simplifies Telescoping Antenna Assembly

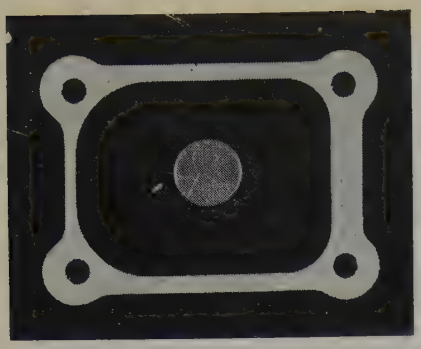
The telescoping antenna used on portable television and radio receivers presents a highly complex assembly. It consists of metal tubing, springs, washers, and ball and socket joints held together in tension and electrically insulated from the cabinet. A newly designed injection molded plastic retainer housing reportedly meets all requirements for ease and simplicity in assembly, mechanical strength, service life, and cabinet style while contributing to product improvement and cost reduction.

The design consists essentially of a barrel with one or two buttress-type grooves molded on the internal diameter. The metal parts are placed in this barrel and compressed until an expansion-type washer snaps into the groove, locking the entire assembly



into a compact foolproof unit.

This same basic design is also used for molding articles with internal threads. There are no complicated gears, core pulling mechanisms, etc., used in the molds. This leads to economy in operation and cost of molds. The molds were designed and constructed by V. H. Swenson Co. Inc., 554 Elm St., Kearny, N. J., which also engineered and pigmented the molding compounds.



Q. Do electrical engineers ever use gaskets?

A. Of course, on weatherproof motors, switchgear and the like, and the following application points out how a material you probably had not thought about for gaskets did a job.

PROBLEM: Select a material to provide an air seal for compressor inlet temperature sensor on the J79 gas turbine engine.

REQUIREMENT: Material must be mechanically strong and impervious to fuel and oil.

SOLUTION: Grade SSFR Insul/struc® glass polyester.

RESULT: Part has given satisfactory service for entire period engine has been in production, over five years.

EXTRA BENEFIT: Reduced transfer of heat from engine frame to sensor mounting plate.

General Electric Co.'s J79 engine has set many records for speed and general performance in both commercial and military aircraft. We are proud that Insul/struc® has contributed to the reliability of this outstanding engine.

"Insulate with Insul/struc"

CINCINNATI DEVELOPMENT & MFG. CO.
5614 Wooster Pike
CINCINNATI 27, OHIO
Print Ins. 47 on Reader Service Card

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that the literature can be sent to you promptly.*

Flame-Retardant Epoxy Resin Brochure

A new flame-retardant epoxy resin for hot-melt castings and dry lay-up laminating systems is described in a new brochure. Instructions for using the "Bakelite" ERL-0625 resin are included, together with tables illustrating physical, electrical, and chemical resistance properties of finished castings and laminates. 4 pages. Union Carbide Plastics Co., 270 Park Ave., New York 17.
Print No. Ins. 301 on Reader Service Card

Polypropylene Market and Property Report

The versatility and broad market potentials of "Tenite" polypropylene are underscored in a new report. Electrical and other properties and characteristics of the material are presented. Handling and processing features are covered, and applications such as wire coating, extrusion coating, pipe and sheet extrusion, and blow molding, are mentioned. Eastman Chemical Products Inc., 260 Madison Ave., New York 16.
Print No. Ins. 302 on Reader Service Card

Epoxy Tubing Technical Data and Price List

Specific applications, a price list, and technical data on epoxy tubing for use as encapsulation containers for electronic components as well as coil forms, spacers, insulators, and other uses are given in a new bulletin. Sizes, tolerances, materials, colors, and ordering are covered. Engineering notes on two encapsulating procedures are included. 4 pages. Resdel Corp., Rio Grande, N. J.
Print No. Ins. 303 on Reader Service Card

Plastic Products Brochure

Latest general products brochure on "Polypenco" industrial plastics for electrical insulating and other applications lists a wide range of materials, stock shapes, fabricated and sintered parts, molding and coating resins, and services available. Materials covered include nylon, molybdenum disulphide filled nylon, TFE-fluorocarbon, cross-linked polystyrene, chlorinated polyether, and polycarbonate. Electrical and other properties, sizes, and applications are given. 16 pages. The Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Print No. Ins. 304 on Reader Service Card

Insulating Films Brochure

Applications and comprehensive charts of electrical and other properties of "Mylar" polyester film and "Teflon" FEP fluorocarbon films are given in new brochure. Information on "Teslar" PVF, polyethylene, acetate, and cellophane films is also included. 8 pages. E. I. du Pont de Nemours & Co. Inc., Wilmington 98, Del.
Print No. Ins. 305 on Reader Service Card

Five Brochures on Silicone Insulating, Other Applications

Five new brochures illustrate and describe many electrical insulating and other applications for silicones in different industries. Titles are: Electronics Engineers' Guide to Silicones (12 pages), Silicones Solve Space Age Problems (8 pages), Give Appliances that Extra Edge for Extra Sales (8 pages), Silicones for the Automotive Industry (8 pages), and How Silicones Work for the Chemical Process Industries (8 pages). Dow Corning Corp., Midland, Mich.
Print No. Ins. 306 on Reader Service Card

Data Bulletins on Mica Sheets and Fabricated Parts

Series of data bulletins outline the properties, specifications, and applica-

tions of mica available in sheets and fabricated parts. The data bulletin series to date covers nine different categories of products. Additional bulletins will be issued each month and will include new product data. A folder to facilitate filing of the information sheets is included. The Macallen Co. Inc., Newmarket, N. H.

Print No. Ins. 307 on Reader Service Card

Alumina Ceramic Standards

Newly published Standards of the Alumina Ceramics Manufacturers Association contains a wide range of data relating to the production, design, selection, purchasing, and use of alumina ceramic materials. Sections deal with properties (including a table of properties), test methods, design fundamentals, dimensional tolerances, visual requirements, quality assurance standards, resistance to nuclear radiation, general manufacturing procedures, metallizing, and application. 20 pages. Diamonite Products Manufacturing Co., Shreve, Ohio.

Print No. Ins. 308 on Reader Service Card

Terminal Board Bulletin

Bulletin GEA-7317 describes sectional and one-piece molded terminal boards for use in panels, switchboards, or any other equipment where it is desirable to group wiring connections. The eight individual sectional blocks available and many factory assembled sectional and one-piece terminal boards are illustrated. Publication explains how custom sectional boards may be made up to meet almost any specification. Kits containing necessary components for making up sectional boards and accessories for the sectional line are also listed. Ratings, dimensions, and ordering information are given for both the sectional and the one-piece boards. 6 pages. General Electric Co., Schenectady 5, N. Y.

Print No. Ins. 309 on Reader Service Card

Catalog of HV Dielectric Test Sets

A new catalog of high-voltage (HV) test sets and power supplies lists 10 pieces of new equipment recently released, including a special cable Hipot tester; insulation oil dielectric tester; multiple output dielectric test set; an economical a-c/d-c test set; a 150 kv, 15 kva a-c test set; a versatile HV a-c test set with multiple secondaries; a motorized output HV test set; an industrial HV d-c power unit; calibrating unit for corona test sets; and a corona pick-up network. Units are illustrated and features of each are discussed. 8 pages. Peschel Electronics Inc., Towners, Patterson, N. Y.

Print No. Ins. 310 on Reader Service Card

Catalog of Thermoplastic Processing Equipment

The various types, functions, and operating features of MPM thermoplastic processing equipment are shown in a new catalog. Each line of equipment described in individual double page sections. The machines illustrated include a complete range of extruders from 1″ to 12″ in diameter, chill roll casting equipment, blow molding equipment, monofilament lines, blown film take-up machines, and special equipment such as laboratory extruders, laminating and casting dies, heavy sheet dies, and many other specially designed units. Catalog also describes and illustrates the design and manufacture of plastic processing equipment. 16 pages. Modern Plastic Machinery Corp., 65 Lakeview Ave., Clifton, N. J.

Print No. Ins. 311 on Reader Service Card

Custom Molding Brochure

New brochure describes custom molding facilities for a complete range of molded plastics from general purpose compression and injection molded products to unique plastics where special mechanical, electrical, and heat resistant properties are required. A plastic materials comparison chart gives the major advantages of the various thermosets and thermoplastic resins along with their physical, mechanical, and electrical properties. 16 pages. Haveg Industries Inc., Taunton Div., 336 Weir St., Taunton, Mass.

Print No. Ins. 312 on Reader Service Card

High-Voltage Dielectric Testing Equipment Bulletin

Bulletin GEA-7178 describes and shows how to select a complete line of 15 a-c and 9 d-c test sets designed for use by electrical apparatus and insulation manufacturers, utility central stations, industrial plant maintenance department, and laboratories to test dielectric materials and all kinds of insulated apparatus. Publication also discusses capacitance bridges, impulse generators, and high-voltage sphere gaps. 12 pages. General Electric Co., Schenectady 5, N. Y.

Print No. Ins. 313 on Reader Service Card

Automatic Wire Stripper Brochure

Brochure on the new model 810A automatic wire stripper contains descriptions and illustrations of new quick-change features. It also pictures and describes an automatic wire prefeed, wire stacker, and other accessories. 6 pages. Eubanks Engineering Co., 260 N. Allen Ave., Pasadena, Calif.

Print No. Ins. 314 on Reader Service Card

Literature on Plastic Processing Equipment for Electronic Industry

New data sheet covers a rotary vane-type high vacuum pump for testing, forming, molding, impregnating, encapsulating, casting, and other uses in the plastics, electrical, and other fields. 1 page. Bulletin 1260 illustrates and describes encapsulating machines, impregnators, high vaccuum equipment, casting cups, and other processing equipment for the electronic industry. 4 pages. Red Point Corp., 105 W. Spazier Ave., Burbank, Calif.

Print No. Ins. 315 on Reader Service Card

Comprehensive Catalog of Ovens And Environmental Equipment

New Catalog No. 161 illustrates and describes a complete line of electric ovens, furnaces, baths, environmental cabinets, related temperature control equipment, and accessories for laboratory, pilot plant, and production. It includes many new models together with all the units added to the line since publication of the last general catalog in 1958. A comprehensive Technical Section supplements the catalog descriptions. The last section provides supplementary data such as scientific charts and tables for use as reference material. 240 pages. Blue M Electric Co., 138th and Chatham St., Blue Island, Ill.

Print No. Ins. 316 on Reader Service Card

Wire Enameling Oven Bulletin

Bulletin GED-4329 describes new controlled convection wire enameling ovens for high-quality magnet wire enameling at twice the speed previously obtainable. Drawings show entire equipment including supply stand, pick-up, preannealer, and oven. Cutaway drawings of oven with call-outs explains construction features of oven. Publication also includes specification chart and picture of control panel along with text explaining how installation, operation, and maintenance are simplified. 4 pages. General Electric Co., Schenectady 5, N. Y.

Print No. Ins. 317 on Reader Service Card

Literature on Multilayer Printed Circuitry

Literature describes new multilayer printed circuit technique which enables six layers of circuitry to be compacted into a plane just .036" thick plus supporting substrate. Details on how multilayer circuitry can accurately reproduce sophisticated patterns is given. Information on flush circuitry and multilayer commutators is also included. Intellux Inc., P. O. Box 929, Santa Barbara, Calif.

Print No. Ins. 318 on Reader Service Card

Catalog of Electrical Insulations For Military and Industrial Use

New catalog A-61 listing electrical insulating products and capabilities for advanced military and industrial applications covers laminated plastics, printed circuit boards, flexible insulation, molded plastics, vulcanized fibre, and mica products. Featured are high temperature plastics and a product/materials directory specially oriented to critical electrical insulating and mechanical applications such as are found in ground-support systems, missile testing and microwave equipment. 16 pages. Continental-Diamond Fibre Corp., Subsidiary of The Budd Co., Newark, Del.

Print No. Ins. 319 on Reader Service Card

Line Post Insulator Bulletin

Bulletin TIA-182 gives detailed information on the features and application of new "Locke" line post insulators which incorporate new wide wire grooves, higher mechanical strength, and a special modern seal. Photographs, line and dimensional drawings, mechanical and electrical characteristics on 5 ASA standard units as well as information on line post studs, and associated mounting hardware are included. 4 pages. General Electric Co., Schenectady 5, N. Y.

Print No. Ins. 320 on Reader Service Card

Catalog of 'Teflon' Shapes

New illustrated catalog lists available shapes and sizes of Teflon plastic shapes. Permissible tolerances are given, and properties and end use applications are described. Shapes catalogued include sheets, rods, tubing, tapes, cementable etched tapes, and large diameter molded bars and cylinders. 8 pages. Cadillac Plastic & Chemical Co., 15111 Second Blvd., Detroit 3.

Print No. Ins. 321 on Reader Service Card

'Teflon' Clamp Brochure

New brochure 216G depicts the use of Teflon as an insulating material for cushioned clamps. A wide variety of shapes and styles of wire harness and tube supporting clamps are illustrated. A completely dimensioned print on the popular loop-type clamp and a chart of the electrical and physical characteristics of Teflon are included. 2 pages. TA Mfg. Corp., 4607 Alger St., Los Angeles 39.

Print No. Ins. 322 on Reader Service Card

New Humistor Bulletin

Bulletin #T-100 describes new model H-160-3 humistor for detecting and measuring vapor and gases which exhibit an electric dipole moment. All features and characteristics are covered. 3 pages. Conrad-Carson Electronics Inc., P. O. Box 2396, Bostonia Station, El Cajun, Calif.

Print No. Ins. 323 on Reader Service Card

Miniature Catalog of Ovens and Other Temperature Equipment

Illustrated miniature Catalog No. 600 covers a complete line of electric ovens, furnaces, baths, environmental cabinets, and related temperature controlled equipment for the laboratory,

pilot plant, and production. Photographs and condensed descriptions giving sizes, temperature ranges, voltages, and capacities are included. 64 pages. Blue M Electric Co., 138th and Chatham St., Blue Island, Ill.
Print No. Ins. 324 on Reader Service Card

Electronic Product Catalog

New catalog No. 105 lists and indexes electronic components, test equipment, and other products of approximately 100 manufacturers. 204 pages. Write Star Electronic Distributors, 7736 S. Halsted St., Chicago 20.

Armature Winder Bulletin

A new double flier automatic model armature winder is described in new bulletin 613AH. Savings in operating time and initial costs, operation, and complete specifications and dimensions are featured. 4 pages. Possis Machine Corp., 825 Rhode Island Ave. South, Minneapolis 26, Minn.
Print No. Ins. 325 on Reader Service Card

Bulletin on Transistorized Ultrasonic Cleaners

New bulletin describes new self-tuning, transistorized 20-kc line of ultrasonic cleaners. The literature elaborates upon advantages over older vacuum tube systems such as lighter weight and compactness, choice of selectable power levels, automatic compensation for load and liquid levels, simple on-off control, no warm-up time, limited maintenance, advanced styling, and high overall efficiencies in the order of 80%. 4 pages. General Ultrasonic Div., Acoustica Associates Inc., 10400 Aviation Blvd., Los Angeles 45.
Print No. Ins. 326 on Reader Service Card

Oven Data Sheet

New data sheet describes, illustrates, and gives specifications for many models of mechanically convected ovens with a temperature range of 35°C to 350°C. 2 pages. The Electric Hotpack Co. Inc., Cottman Ave. and Melrose St., Philadelphia 2, Pa.
Print No. Ins. 327 on Reader Service Card

Catalog on Pumps for Mixing And Dispensing Resin Systems

New catalog covers all details on pumps for proportioning, mixing, and dispensing multicomponent resin systems. In addition to illustration and specification data for each model, general information is given on applications, operations, volume and viscosities, servicing, and personnel training. 10 pages. H. V. Hardman Co. Inc., Belleville 9, N. J.
Print No. Ins. 328 on Reader Service Card

Automatic Coil Winding Brochure

Brochure titled "The Technique of Fully Automatic Coil Winding" describes the operation of the Aumann model WPA coil winding machine which can be equipped for semi- or fully-automatic winding of field coils, bobbins, voice coils, armatures, etc. It also illustrates and describes the operation of a refinement of Model WPA, a fully automatic machine which inserts the bobbin, starts the wire, winds the coil, cuts the wire, seals the winding, and then ejects the wound coil. 8 pages. Industrial Winding Machinery Corp., P. O. Box 744, Church Street Station, New York 8.
Print No. Ins. 329 on Reader Service Card

Brochure on Wire De-Reelers

Wire de-reelers designed to suit any winding conditions, and to fit every gauge, are presented in a new brochure. Payoffs, tensioners, takeoffs, and feeders for both rolling reels and over-the-end (stationary) reels are covered, with particular features and recommended applications for each de-reeler given. For convenience, a selection chart gives the range of wire diameters accommodated, maximum and minimum tension, and reel dimensions for 18 different de-reelers. 6 pages. Associated American Winding Machinery Inc., 750 St. Ann's Ave., New York 56.
Print No. Ins. 330 on Reader Service Card

Punch and Die Facilities Bulletin

Greatly expanded facilities for designing and producing precision punches and dies for wide variety of forming operations—such as the compacting of ceramics, electrical porcelain, and glass seals—are described and illustrated in a new folder, bulletin 455. 4 pages. Punch and Die Div., F. J. Stokes Corp., 5500 Tabor Road, Philadelphia 20.
Print No. Ins. 331 on Reader Service Card

Dates to Circle

Meeting and Convention Notices

July 3-7 . . . Gordon Research Conferences, Polymers, Colby Junior College, New London, N.H.

July 17-21 . . . Gordon Research Conferences, Elastomers, Colby Junior College, New London, N.H.

July 18-20 . . . Western Plant Maintenance and Engineering Show, Pan Pacific Auditorium, Los Angeles.

July 27-Aug. 1 . . . International Symposium on Macromolecular Chemistry, Montreal, Canada. Address inquiries to: The Organizing Committee, International Symposium on Macromolecular Chemistry, P. O. Box 816, Sarnia, Ontario, Canada.

Aug. 15-17 . . . Cryongenic Engineering Conference, sponsored by University of Michigan, Ann Arbor, Mich.

Aug. 16-18 . . . Second International Electronic Packaging Symposium, sponsored by University of Colorado, Boulder, Colo.

Aug. 22-25 . . . WESCON, The Cow Palace, San Francisco.

Aug. 23-25 . . . AIEE, Pacific General Meeting, Hotel Utah, Salt Lake City, Utah.

Sept. 12 . . . SPE, Plastics for Tooling, Retec sponsored by Central Indiana Section, Hotel Severin, Indianapolis, Ind.

Sept. 14-15 . . . Engineering Management Conference, AIEE and ASME, Hotel Roosevelt, New York City.

Sept. 21-22 . . . Industrial Electronics Conference, AIEE, IRE, and Instrument Society of America, Bradford Hotel, Boston, Mass.

Sept. 24-27 . . . AIEE-ASME, National Power Conference, St. Francis Hotel, San Francisco.

Sept. 24-29 . . . Illuminating Engineering Society, National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo.

Sept. 25-28 . . . American Welding Society, Fall Meeting, Adolphus Hotel, Dallas, Texas.

Oct. 1-5 . . . Electrochemical Society, Statler Hotel, Detroit, Mich.

Oct. 2-4 . . . IRE; Canadian Electronics Conference, Automotive Building, Exhibition Park, Toronto, Canada.

Oct. 9-11 . . . National Electronics Conference, sponsored by AIEE, IRE, Illinois Institute of Technology, Northwestern University, and the University of Illinois, Hotel Sherman, Chicago.

Oct. 10-12 . . . ASA, 12th National Conference on Standards, Rice Hotel, Houston, Texas.

Oct. 12-13 . . . SPI, 17th Annual New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N.H.

Oct. 15-20 . . . AIEE, Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich.

Oct. 23-25 . . . Conference on Electrical Insulation, National Academy of Sciences —National Research Council, Pocono Manor Inn, Pocono Manor, Pa.

Oct. 23-25 . . . IRE, East Coast Conference on Aerospace and Navigational Electronics, Lord Baltimore Hotel, Baltimore, Md.

Oct. 23-26 . . . The Wire Association, Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

Oct. 25 . . . SPE, Plastics in Major Household Appliances, sponsored by Kentuckian Section, Monogram Hall, Appliance Park, Louisville, Ky.

Oct. 26-28 . . . IRE, Electron Devices Meeting, Sheraton-Park Hotel, Washington, D.C.

Oct. 30-31 . . . IRE, Radio Fall Meeting, Hotel Syracuse, Syracuse, N.Y.

Nov. 7-9 . . . Eighth Industrial Electric Exposition, Electric League of Western Pennsylvania, Pittsburgh Room, Penn-Sheraton Hotel, Pittsburgh, Pa.

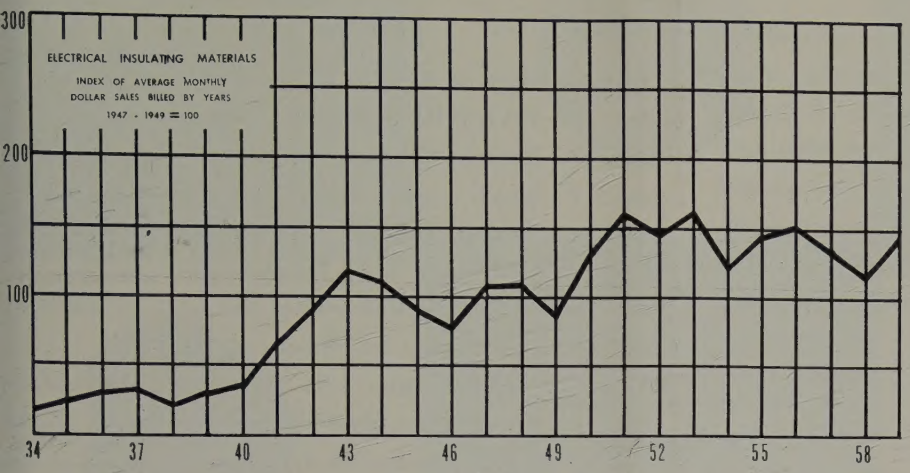
Nov. 16 . . . NEMA, Annual Meeting, Summit Hotel, New York City.

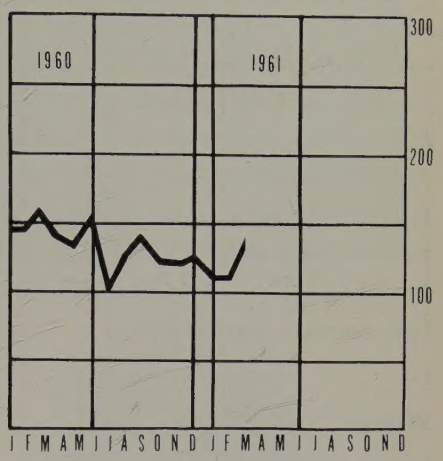
Dec. 12-14 . . . Eastern Joint Computer Conference, Sponsored by AIEE, IRE, and Association of Computer Manufacturers, Sheraton-Park Hotel, Washington, D.C.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing Materials	EASA	—Electrical Apparatus Service Assn.
ASME	—American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index





	Mar. '61	Feb. '61	Mar. '60
Index Series	144	118	168
Mar. '61 point change from other mos.		+26	−24
Mar. '61 % change from other months.		+22	−14

Index is based on 1947-1949 average month, inclusive= 100

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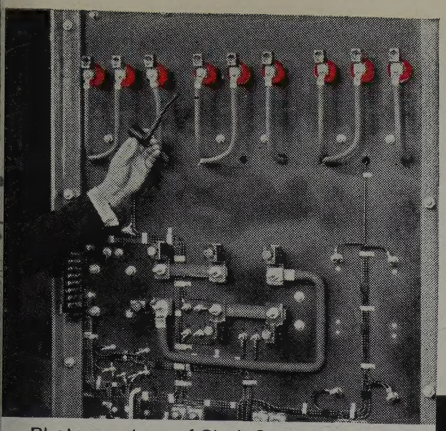

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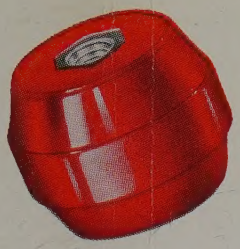

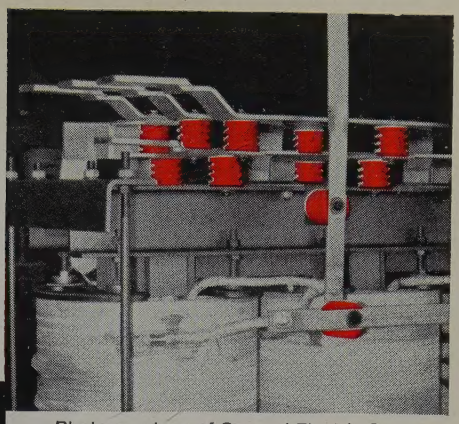

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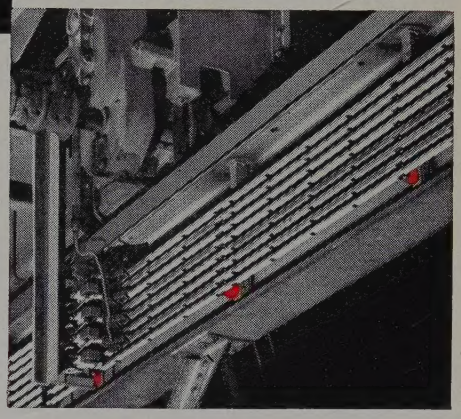

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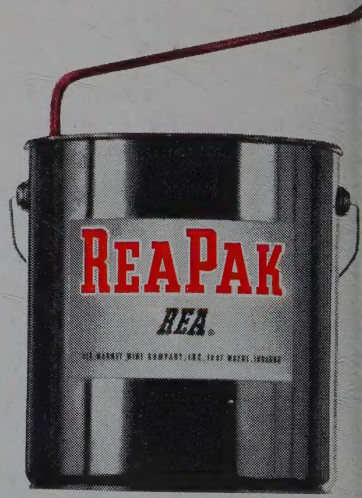

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